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WHAT WE'RE ANTICIPATING



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MEET THIS ISSUE'S EXPERTS







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Andrew has a PtO
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GLOBAL EYE

Critically endangered
California condors
(Gymnogyps californianus)

Condor chicks have virgin birth

ORDS MINDY WEISBERG

cientists have reported the first Some virgin birthis in California condors: two chicks that hatched without any males imbored in fertilising the eggs. Researchers recently made the unexpected discovery that the genomes of these two birds contained no DNA from any condor males. This made the two fatheriess condors rare examples of a type of sexual perpoduction called.

port hamogenesis. During part hamogenesis, sportnamous Luring part hamogenesis, sportnamous embryonic development occurs without fertilitation. It is not but not unheaved of in fertilitation. It is not but not unheaved of individual control of the control of th

In the 1980s, fewer than two dozen condors remained in the wild, but dedicated conservation efforts and breeding programs brought condors back from the brink of extinction. As of 2020, there were 504 condors, of which 329 were wild and free flying; However, the species is still considered to be critically endangered.
Finding that condors can reproduce asexually
– potentially increasing the species' chances
of producing offspring – is therefore a pretty

But when the researchers analysed the genotypes of two male condors in the database, which had been released into the wild but are now deceased, they noticed something extremely unusual; genetic information in the two birds matched up only to the females that hatched them. According to the database, no male qualified as a potential sine.

"When animals reproduce sexually, females and males contribute to the genetic makeup

equally. But in these two condors, we couldn't find any contribution coming from any male we had in our database," Steiner said. "That was a red flag," One possibility that the

was a rod fag. One possibility that the societatis considered was an error in the bards' genetic leaks, so they repeated the process. The results didn't change.

At that point, it was like a eureka moment which we figure out that parthers possibility. Stellar said, "They possibility should be said," They are said to the parthers of these are not considered to the parthers of these to include a said of the parthers of the parthers of the participation of the parthers of the

paternal contribution Condor chicks born via parthenogenesis would be male-only. That's because only two matching sex chromosomes can be formed during this type of asexual reproduction. And in condors, it's the females that have the mismatched sex chromosomes. "Different sex-determination chromosomes are used in birds and humans: the XX/XY (female/male) system in humans versus the ZW/ZZ (female/male) in birds," Steiner said. When the mother condor fertilises her own eggs the resulting offspring all have ZZ chromosomes - WW is not a viable match up The mothers of these two birds had produced multiple chicks over time via sexual reproduction, but further study would be required to determine the factors that led them to reproduce asexually



Dinosaurs attempt to flee a wildfire on Antarctica during the Late Cretaceous

HISTORY

WILDFIRES BURNED ANTARCTICA 75 MILLION YEARS AGO WORDS LAURA GEGGEL

Raping wildfres fore through Antarticis 75 million years ago, back when disosaurs still rearned the Earth During the Lade Cretacous Period, one of the warmest periods on Earth which ran form Dol million to 66 million years ago, Antarctica's James Roos Island was home to a temperate forest of conflers, ferns and flowering plants known as angiosperms, as well as to a slew of dinosaurs. But it wasn't a total paradise micent 'paleoffres' burned parts of those forests to a cripp, learing behind charcoal

remnants that scientists have now scooped up and studied. In 2015, researchers documented the first known evidence of dinosaur age wildfires in West Antarctica. For the recent work, an international team of scientists analysed fossils collected during an expedition to James Ross Island. These fossils contained fragments of plants that looked like charcoal residue, which had weathered away over the past tens of millions of years. The charcoal fragments were small - the largest paper-thin pieces were just 19 by 38 millimetres. But scanning electron microscope images revealed their identity. These fossils are likely burned symnosperms, likely from a botanical family of coniferous trees called Araucariaceae.

SPACE

Jupiter's Great Red Spot is over 200 miles deep

WORDS BRANDON SPECKTOR

That's far deper than researchers expected, with the bottom of the storm extending will below the statem extending will below the statem extending will below the statemapheric level where water and ammonia are expected to condices from clouds. The storms deep rocts suggest that some asyet unknown processes levil, Jupiter inferior and deep atmosphere, chiving intense meteorological events over much larger scales than previously thought. We're getting our first real understanding of how Jupiter's breadful and voicent atmosphere works, "said Scott Bottom crinical investant or in NASA's.

Juno mission. NASA's Juno probe entered Jupiter's orbit in 2016 and has since completed 36 passes of the nearly 87,000-mitewide gas glant. Researchers examining the Great Red Spot used the probe's microwave radiometer, a tool that detects microwave emitted from inside the planel. Unlike the radio and infrared radiation emitted by the gas glant. microwaves can make it, all the way through the

planet is think cloud layer. By studying the microwave emissions that made it through the Great Red Spot, the researches have delement of that the storm delement of the storm of the storm been discovered that the spot may be even beginn than that. The Great Red Spot was examined using Jurio's greatly delection took examined using Jurio's greatly delection took examined using Jurio's greatly delection took of the storm of the storm examined using Jurio's greatly delection soot researches the ordicalised of these the storm was concertaining the most atmospheric took design. Researches have determined that the storm was controlled and the storm to the storm of the storm to the storm of the storm the storm was concertaining the most atmospheric to depth. Researches have determined that the milks below the cloud from.

As deep as this seems, the Great Red Spot is still much shallower than the enormous jets of wind that surround and power it; those bands of wind extend to depths of about 2,000 miles below the cloud toos.



Childrey / Wild Maydo Cheera De Linna, F.J. et al. Pider Research / NXSA/JPL-

GLOBAL EYE



HEALTH

Your pupils can count... sort of

WORDS VASEMIN SARI AKOGULI

he pupils of your eyes might be able to count, in a manner of speaking. Recent research suggests pupil size can change based on the number of objects an individual observes in their visual field pupils are holds located in the centre of the eye which change size to regulate the amount of gifts that enters the eye based on how much is available in the environment. The response of our pupils to light in a basic sensory response, but pupils to light in a basic sensory response, but pupils new been found to change size based on forms other than light syst has considerable for the change size based on factors other than light syst has a mind they are a small and a size of the change size based on factors other than light syst has grain, but syst has grain, but any the second of the change size based on factors other than light syst has grain, but any the second of the change size based on factors other than light syst has grain, but syst has grained to the change of the ch

Researchers hypothesisot that pupils may also change site based on the number of objects that a person sees in their environment. It's thought that most species have a certain "number sense", said study countinor David Burn, a professor at the linevisety of Sydney and the Linvertily of Florence. Previous research has suggested that humans may develop a 'drude' number discrimination' as soon as a few hours often before the country of the

after birth.

When we look around, we spontaneously or when we look around, we spontaneously perceive the form, size, movement and colour of a scene. Equally spontaneously, we perceive the number of items before us," Burr said. "This sability, shared with most other entimels, is an evolutionary fundamental. It immediately reveals important quantities, such as how many applies there are or the free, or how many enemies are affectioning."

To figure out if this ability less within the pupils, the researchers presented if Sault juricipants with images of dots on a monitor in an otherwise cutel, dark room. As the participants stared at the screen, without being asked to count the dots, a machine measured their pupil stees. The images contained either 18 or 36 black or white dots, and each dot what so others people stees. The images contained either 18 or 36 black or white dots, and each dot dawns others people are on the intensity of the steep of the steep

The researchers found that the size of the participants' pupils changed depending on how many dots they perceived. The participants' pupils dilated, or expanded, when they perceives a greater number of dots and constricted when they penceived fewer dots.

The findings suggest that the pupil is equipped with some mechanism that can sense quantity. "This result shows that runnerical information is intrinsically related to perception," said Elisa Castald, a postdoctoral researcher at the University of Pisa. "This could have important

For example, similar methods could be employed to detect dyscaloula, a learning disability that makes people have trouble doing maths, in very young children. "It's very simple: subjects simply look at a screen without making any active response, and their pupillary response is measured remotely," Castadia added. SPACE

GODZILLA NEBULA LOOKS LIKE A SPACE LIZARD

WORDS STEPHANIE PAPPAS

What do you see in this image of space gas and dust? Perhaps the greenish blob puts you in mind of a frog, a crocodile or even Slimer from Chrosthusters. One scientist is potity of the scientist is possible or fact the property of the scientist is possible or Earth, space clouds can trigger pareidolia, the recognition of a face or familiar object in an ambiguous pattern. And the Godzilla nebula which not of looks like the space lizzed, but potentially like any other which sort of looks like the space clazed, but potentially like any other cannot get the phenomenon.

example of the phenomenon. "I wasn't looking for monsters," said Caltech astronomer Robert Hurt, who catalogues images from NASA's Spitzer Space Telescope. "I just happened to glance at a region of sky that I've browsed many times before, but never zoomed in on. Sometimes if you just crop an area differently, it brings out something that you didn't see before. It was the eyes and mouth that ransed' (Godzilla' to me."

This space monster is actually in the constellation Sagittanius. The stars that make up Godzilla's nose and eyes are within the Milky Way, though their distance from Earth ian't known. The bright region to the lower left, which Hurt Imagines as Godzilla's outstretched claw, is a star-forming region called W33.



Pareidolia tricked an astronomer into seeing Godzilla in this Spitzer image of a cloud of dust and gas

WORDS PATRICK PESTER

reat white sharks can't see the difference between their typical prey and humans swimming or paddling on surfboards, suggesting me shark attacks are cases of mista identity, Researchers filmed seals and humans in water and edited the footage so that it natched the vision of juvenile great white sharks, which pose the greatest risk to human surfers. They found that the shape and motion of humans look the same as seals from a shark's perspective. The study is the first to test the theory that sharks attack humans because they mistake people for prey "White sharks are often portraved as

'mindless killers' and 'fond of human flesh However, this doesn't seem to be the case we just look like their food," said Laura Ryan, a neurobiologist and postdoctoral researcher at acquarie University in Australia. Great whites (Carcharodon carcharias) are responsible for more human deaths than any

er shark species and killed six people in 2020, although the relative risk of hu being bitten by sharks is still extremely low These sharks start hunting seals when they are about 2.5 metres long. They develop a

search image for their prey and combine that with other sensory information, such as smell to know what to eat. It's a learning process that could be prone to mistakes. Great white sharks lack colour vision and cannot see fine details like the human eye can. The researchers processed the videos they filmed to reflect how a shark's retina detects the motion and shapes of seals and compared that motion to humans swimming and loneboard (2.83 metres by 0.58 metres) and shortboard (1.77 metres by 0.5 metres surfboard. They concluded that none of the scenarios were visually distinct for a juvenile

great white shark swimming below "I knew there would be some similarities but maybe not to the extent we found," Ryar said. "Specifically, I thought swimmers m not be as similar as a surfer to a seal, as they typically aren't involved in as many shark ites. However, the swimmers were also difficult to tell apart from a seal.

The longboard surfboard was less similar to seals, indicating there are some small differences in the way a great white shark might perceive the shape of longboard

surfboards compared to shortboard surfboards and swimmers. However, the researchers don't know how that is reflected in shark behaviour because sharks bite humans on longboards too.

is open at the surface

The new research only applies to great white sharks, and there are other sharks, such as bull sharks and tiger sharks, that also ature great white sharks also sometimes bite humans, and when they are older, more experienced hunters, they may make fewer mistakes. In other words, not all bites are Great whites are vulnerable to extinction

necessarily due to mistaken identity

and humans deliberately kill them as part of beach-protection programs in Australia and South Africa, though sharks are sometimes captured and released. Not knowing why sharks attack humans creates public concern and leads to humans introducing measures to reduce shark populations, which also has harmful effects on other marine life. Sharks ay important roles in ocean ecosystems; by nting other animals, they ensure prev ons remain healthy and at a size their bitat's resources can support

PLANET EARTH

Huge hole discovered in Arctic's 'last ice'

WORDS STEPHANIE PARPAS

Did

rapidly closed

huge hole opened in the Arctic's oldest, thickest ice in May 2020. Scientists previously thought that stable, but the giant rift signals that the ancient open water is the first to be observed north of Filesmere Island. But researchers deduced from old satellite data that similar notyrivas may have

opened in 1988 and 2004. "North of Ellesmere Island it's hard to move the ice around or melt it because it's thick, and there's guite a bit of it," said Kent Moore, an Arctic researcher at the University of Toronto-Mississauga, "We generally you know? haven't seen polynyas form in that. age of five years. But this 'last ice' is.

occurring in northern latitudes. In summer 2020, the Wandel Sea, or the eastern reaches of the 'last-ice' region, lost half of its overlying ice. A 2021 study showed that the ice arches that connect the stable sea ice to Greenland are forming later and melting faster each year,

the century, spelling the end for animals that depend on year-round sea ice, such as polar bears. The polynya is another bad sign for the last ice. Polymyas are cracks in the sea ice that often onen un during storms, when strong winds of Ellesmere Island in May 2020, and satellite imagery showed that a long narrow crack or lead formed on 14 May Ry 15 May the lead had evolved into an ellintical polynya about 62 miles long and 18.6 miles wide. On 26 May the polynya

> really interesting," said David Babb, a sea ice researcher at the University of

changing." In the future, nolvinyas might open up more frequently as the Arctic's last ice melts. Moore said.

"The formation of a polynya in the area is

In the short term, these areas can be cases for lifer sumlight hits the ocean water, allowing for more algal photosynthesis, which attracts fish seahinds seals and notar hears he added Rut this explosion of life is only temporary

The gap in the ice was open for around two weeks in May 2020 due to strong anticyclonic winds in the Arctic polynya Fllesmere Island

HISTORY

SKELETON OF MAN FLEFING UESHUILIS FRIIPTION DISCOUERED

WORDS STEPHANIE PAPPAS The hones of a man who was unable to escape the eruption of Mount Vesinins in 79 CF have been found in the ancient Roman town of Herculaneum. The skeletal remains were discovered near a stone wall along the ancient seafront, the first discovery of a Vesuvius victim in Herculaneum in 25 years. The hones belonged to a man in his early 40s. He may have died in the final phase of the enuntion when gas and ash rushed through the town at more than 60

miles per hour and around 500 degrees Celsius in a pyroclastic flow Researchers found the skeleton with its head towards the sea and surrounded by carbonised wood. A large roof beam found near the body may have crushed the man's skull. It's not clear who the man was or what he was doing when he died. He may have been a town resident who left a shelter to look for a rescue boat, only to be caught up in the devastating last moments of the eruntion. Or he may have been a soldier with the rescue effort who ended up stranded among

those he was trying to save The team now plans to remove the chunk of hardened ash that encases the victim's body and then excavate the skeleton in a laboratory environment. Fragments of metal and

fabric near the skeleton may be a bas holding tools, weapons or coins, Investigating the contents of the bag could yield hints to his identity



A view of excavations of the Roman town Herculaneum, buried by Vesuvius in 79 CE

Alien planet 'aurorae' may send signals towards Earth

BRANDON SPECKTOR



our brand-new alien planets have potentially been discovered after scientists detected the shimmering radio flashes of

aurorae in those planets' atmospheres Aurorae occur when the solar wind intense gusts of electric particles belched out by the Sun, smash into a planet's magnetic shield Earth experiences aurorae pear the porth and south poles, where miraculous displays of colour and light streak through the sky. But this pleasant light show is only a piece of the story; astronomers know that the cosmic clash of the solar wind and magnetic fields also produces bright flashes of radio light that can be seen far across the galaxy. To an alien observer hundreds of light years away, the aurorae of Earth may look like sudden, bright explosions of radio energy

Scientists think they've discovered four planets within 160 light years of Earth by detecting the shimmering radio flashes of aurorae in those planets' atmospheres. If confirmed by future research, these four alien worlds will be the first planets detected

through radio waves, potentially opening a new avenue for planetary detection in our galaxy. "It's a spectacle that has attracted our attention from light years away," said Joseph Callingham, an astrophysicist at Leider University in the Netherlands

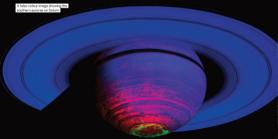
The researchers discovered these potential planets somewhat accidentally while surveying nearby red dwarf stars with the Low Frequency Array (LOFAR) radio teles in the Netherlands. Red dwarfs are much smaller, cooler stars than our Sun and are thought to be the most common type of star in the galaxy. These stars typically have very large magnetic fields, and tend to flare up with gigantic bursts of energy that are visible across the electromagnetic spectrum

Of the 19 red dwarfs the researchers detected, four seemed a little unusual. These oddball stars appeared very old and magnetically inactive, yet they still shined with bright radio signals. If these signals weren't the result of large magnetic flare-ups. then what could be causing them? Using a mathematical model, the team concluded

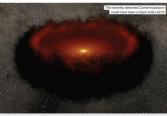
that the strange radio signals are most likely from a powerful auroral process occurring in the atmospheres of unseen, undiscovered planets orbiting the old stars. The process is similar to aurorae on Earth, with charged solar wind clashing with a magnetic field, but they may behave more like the powerful aurorae seen on Juniter

"Aurorae from Jupiter [are] much stronger as its volcanic moon to is blasting material out into space, filling Jupiter's environment with particles that drive unusually powerful aurorae," Callingham said, "Our model for this radio emission from our stars is a scaled-up version of Jupiter and Io." With radio data alone, the researchers can't be sure that hidden planets are responsible for the strange signals around these old stars. However

powerful planetary aurorae seem to be the most plausible explanation right now Further observations of the withered stars could reveal if the team's theory is correct and whether bright blasts of radio energy can help lead astronomers to more alien worlds in



GLOBAL EYE



SPACE

Ultrahot, ultrafast explosion has astronomers puzzled

WORDS RRANDON SPECKTOR



peak brightness within a few days and then rapidly vanished again within a month, indicating that an extreme cosmic event, like the formation of a black hole or neutron star, had just occurred.

Astronomes call sudden Inigit blacks like here Set bid to policy Lanceinst, 1960 15, anned for their externer black heat and incredibly rapid evolution. But you can call this one the Carmel. That inciname — a play on the object's technical mere, ZTEOLogical—may seem unfetting for ablack so that and powerful. but such is the way 1970 15.8 annies repiscion defected in 2018. roughly 200 million light years from Earth, credity 200 million light years from Earth, credit years of the control of the control of the roughly 200 million light years from Earth, credit years of the roughly 200 million light years from Earth, credit years of the roughly 200 million light years from Earth, credit years of the roughly 200 million light years from Earth, so when the Set of Set of

These three HBUIs are in a class of their own when it comes to stellar explosions. Unlike typical supernovae, the epic blasts that occur when stars run out of fuel and collapse, FBOTs seem to appear and disappear in a matter of weeks, rather than years.

rather than years.

But even after their visible light fades, FBOTs continue to be radiation powerhouses. Recently astronomers studied the Carnel in wavelengths.

across the electromagnetic spectrum, getting a glimpse of some of the invisible carnage playing out after the initial blast.

The research team found that the initial Camel explosion also shone brightly in radio frequencies, suggesting that the blast was tearing through its cosmic neighbourhood extremely quickly, probably a few teriths of the speed of lafet.

speed of light.

Such bright radio emissions usually come from synchrotion radiation, which occurs when from synchrotion radiation, which occurs when from synchrotion radiation, which occurs when the light at a fraction of the speed of light. Behind the blast, a powerful engine seethed for morths. Researcher's found that the blast glowed with X-ray emissions long after its visible light factor. As with the loco with six framen of X-rays suggests that comething powerful—like a black hold or a metal-ratio att — was driving the Camels in

intense emissions. It could be that FBOTs represent a rarely seen moment of cosmic creation, blasts that cour the instant and old star mipodes, colleging into a massive black hole or fast-spinning neutron start shorts or seen these processes actually take place—at below or very experience or very experience place or the seen these processes actually take place—at below as far as they know — so it's hard to know for sure what the resulting flood of radiation would look like. But one thing a clear the Cox, the Koola and the Carried are not your average.

PLANET EARTH

LIFE LOCKED INSIDE A RUBY

Traces of ancient life have been found inside a 2.5-billion-year-old ruby from Greenland. The planet's oldest rubies, gemstones made up of a transparent red mineral called corundum, are found in Greenland. While searching for rubies in the North Atlantic Craton, researchers discovered a hidden surprise in one of them: graphite, a pure form of carbon, which may be the

remains of ancient microbial life.

"The graphic inside this ruly is really unique." said Chris Yaklymchuk, a professor at the University of Waterson in Ontario. "It's the first time we've seen evidence of ancient file in ruly bearing rocks." The team concluded the graphic came from an ancient file form after they analysed that ratio of different alsoopse of carbon. More than 50 per cent of the standard control of the control of the standard control of the s

"Living matter preferentially consists of the lighter carbon atoms because they take less energy to incorporate into cells." Yakymchuk said. "Based on the increased amount of carbon-12, we concluded that the carbon atoms were once ancient life. most likely dead microorganisms such as cyanobacteria." At the time this bacteria likely lived, the planet didn't have much oxygen, an indispensable element for complex life, so the only life that could eke out an existence were teeny microbes and algae films. Cyanobacteria are thought to be some of the first life on Earth.



Scientists discovered hints of ancient life inside a 2.5-billion-year-old ruby

PLANET EARTH

'Hidden world' discovered in Earth's

core

WORDS JOANNA THOMPSON

alloy surrounded by a liquid outer core. But recent research suggests that the firmness of the planetary ball ranges from hard to semisoft to liquid metal. "The more we look at it, the more we realise it's not one boring blob of iron." said Jessica Irving, a seismologist at the University of Bristol. "We're finding a whole new

arth's 'solid' inner core might

In some ways, Earth's inner core remains as mysterious as it was when Jules Verne published his fanciful Journey to the Center of the Earth in 1864. Though scientists have known since the 1950s that our planet isn't hollow, as Verne predicted, the planet's interior is still unexplored: the immense heat and pressure are too great for any human or human-made probe to travel there "Unless something awful happens to our planet, we will never have a direct observation of Earth's core," Irving said.

Instead, geophysicists rely on seismic waves generated by slow down or bounce off different mediums as it travels

For Rhett Butler, a geophysicist at the Hawaii Institute of Geophysics and Planetology, the study started as a question of mismatched numbers. Butler was looking at how the seismic waves created by large earthquakes in five different locations travelled through Earth's core to the exact opposite side of the globe. But something was off; the quakes' shear waves, which should have passed through a solid ball of metal. were instead being deflected in certain areas

The numbers surprised Butler. He knew the seismic wave maths was correct, which could mean only one thing... scientists had the structure wrong. "When you're in this business, you've got to match the data," he said. Researchers reevaluated their base assumption that Earth's inner core was

They discovered that the waves they

observed worked if, rather than being a solid ball, the core had pockets of liquid and 'mushy', semi-solid iron near its surface. The range of iron consistencies was particularly striking. "We've seen evidence that not only is it not soft everywhere, it's really hard in some places," Butler said, "It's got hard surfaces right up against melted or mushy iron. We're seeing a lot of detail within the inner core that we didn't see before. Earth's magnetic field. While the swirling liquid outer core drives our planet's magnetic field, the inner core helps to

modify the field. Other planets. Ike Mars, have a liquid centre but lack both an inner core and a magnetic field. Therefore, Butler and Irving believe, a deeper understanding of the inner core will help scientists understand the relationship between a planet's interior and its magnetic activity.

WISH LIST

PLAYTRAINS SETS

If you know any children wanting to start a special model raiway adverture which they can develop, build, interact with and ultimately how bundles of fau with, then look no further! The Playtraina remote-controlled battery train sets and accessories form a completely new range of to by trains that feature working lights, multiple sounds, three speeds in both forward and reverse and an executor for forward and reverse and an executor file.

together track system, plus lots more. With additional items available, including individual locomotives, rolling stock and track packs, there are endless opportunities



These are not just any toy trains though — these trains have names, taces and personalities. They have stories to tell, adventures to go on and friends to make. 'Flash', 'Bolt' and 'Thunder' are the hero characters, and children will be able to learn

all about them via the Playtrains Portal. The portal hosts piently of fun and engaging information, including a Playtrains kids zone, character stories and personality profiles, educational learnings, videos and more.





FLOATING 3D MOON LAMP

Bring the magic of the Moon into your home with this growth-olying larm. This 3D light uses magnetic-levitation technology to float and spin in mid-air fielly whout any support or contact. The larm also comes with three colour modes to suit your environment and moon, from a warm yellow glow to a perfect funar white. The base of the Moon almap is also bouch sensitive, changing through its colours and switching on and off with a single tap.



If you're looking to get your child their very first smart device, then the XGO2 by Xplora is a great place to start. These feature-rich devices are an ideal first mobile phone and GPS tracker for children aged 5 to 12.

make and receive calls and send text messages to saved numbers only. It also comes with an SOS button to notify their emergency contact of their location. There is also a built-in camera to snap and share photos – however, there's no access to social media platforms. A fun feature of these watches is that they not only court like's steps, but turn them into Xplora coins

games platform

THAMESANDKOSMOS COLIK / STORE THAMESANDKOSMOS CON

Get to grips with advanced tonics in physics like fluid dynamics, energy Kosmos, Inside is a 96-page experiment manual that guides you through sections. In the first part. young scientists can learn about the

properties of air water and energy through 17 brilliant experiments. In the second section they can apply their knowledge and build 14 models of complex real-world devices. All together this kit is packed with 212 parts for budding physicists and engineers to enjoy



Always dreamed of owning a Lamborghini? Airfix Quick Build is an exciting range of simple, snaptogether models suitable as an any Lamborghini lover! There's no paint or glue involved, so the model

can be crashed and rebuilt as many times as you like, or you may choose

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Christmas reading list

GUINNESS WORLD RECORDS 2022

ALITHOR: GUINNESS WORLD RECORDS



Discover a unique mix of remarkable humans, talented nets incredible vehicles impressive sporting legends and the latest cutting-edge science Despite the challenges

of 2021, the team at Guinness. World Records has yet again compiled the latest the world. Inside you'll find chapters including environmental champions, sporting heroes, the

NATURE'S TREASURES

AUTHOR: BEN HOARE



Dive into this collection of items from the natural world hehind them Written by award-winning journalist Ben Hoare examine a whale's

bristly teeth and learn how they eat tiny animals see why butterflies shine and plitter in the sunlight with their miniature wing scales and discover what makes every snowflake unique by admiring their tiny, branching crystals of ice

DINOSAURS AND OTHER PREHISTORIC LIFE

AUTHOR: ANUSUYA CHINSAMY:TURAN



This is a wonderful eift for any dinosaur fan - perfect for children to explore by themselves or to read with an

woolly mammoths, every page will captivate young readers. Go on a time-traveling adventure and marvel at the plants and animals from the Earth's primaeval past in this stunning book about dinosaurs and prehistoric life

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EDGE OF THE UNIVERSE

NASA's James Webb Space Telescope will be the most powerful in history, giving us the deepest ever view into space

> WORDS ANDREW MAY



he Hubble Space Telescope is a hard act to follow. In the three decades since it was launched in 1990, it's revealed the wonders of the universe in unprecedented detail. It's been used to study cutting-edge topics like dark energy and exoplanets that were scarcely dreamed of when it began ration. It's also captured the public's imagination to the extent that it's now a household name. That's the kind of reputation Hubble's successor will have to live up to That successor is called the Jame Webb Space Telescope (JWST), or h for short Like Hubble it will be erated primarily by NASA, which is ng the bulk of the funding ith the European Space Agency (ESA) as a junior partner. The telescope is named after one of NASA's early administrators Did James E. Webb, who oversaw the creation of the Apollo program in the 1960s. It was way back in

had previously been retained to as the Next Center at on Space as the Next Center at on Space is a summarized by the Next Center at one of the Next Center at one of the Next Center at one of the ready for summarized to control to the Next Center at one of the Next Center at the

2002 - almost 20 years

ago - that Webb's name

was first applied to what

molecule in the project believe the setuals will meet than compensate for the time and money invested in it. NASA is seen to emphasise that Webb inst simply a bigger and more powerful replacement for Hubble. It's both of those things, to' course—with more than the oad a half times the diameter and a hundred times the sensibility—but a heart it's a differently pie of instrument altergeture. Crimary optical telescoppes see in the same part of the spectrum as our eyes, covering a telescoppes see in the same part of the spectrum as our eyes, covering a telescoppes.

telescopes see in the same part of the spectrum as our eyes, covering range of wavelengths between roughly 380 and 740 nanometres (nm). Hubble spanned all of this, plus a little way into the ultraviolet at shorter wavelengths and infrared at longer ones. But the JWST will primarily be an infrared telescope, optimised for 600 to 28,000 nanometres. It won't be tible to see green or blue light, just orange and on, plus a wide range of longer wavelengths beyond that.

For move astronomical objects.

For merly astronomical objects, helse very long windlengths are more wisible spectrum. But infrared possivisible spectrum. But infrared possiproblems for Earth-based observers, because much of it is blooked by our planet's atmosphere. On top of that, planet Earth produces its own infrared emissions via heat radiation, which tend to swamp the fainter and the planet's atmosphere of place for an infrared telescope is out, via space, as far as possible from the Earth and all its unwanted sources.

Following in the footsteps von know? of the ESA's Herschel Webb is the infrared observatory. largest telescone Webb will be located ever placed in around 932,000 miles Space from Earth at Lagrange point L2. This will give it a much clearer view of the universe than the one Hubble has in low-Earth orbit, but it does have a downside Unlike its predecessor, it won't be a relatively simple matter to send astronauts up to repair it if it breaks down. Everything has to work perfectly on the first attempt, which is one of the reasons it's taken NASA

the best part of two decades to get it

ready for launch



How worl

The telescope has some unique design features, like a segmented mirror and a huge sunshield

Externally, Webb looks very different from Hubble. The latter, just like a traditional telescope, is enclosed in a cylindrical tube that shields the optics from stray light Depending on its position in its orbit, Hubble supshine from one direction, reflections from the Moon. But Webb is more fortunate. Seen more or less the same direction, so all the telescope needs is a single large sunshield The bare optics, in the form of primary and secondary mirrors, sit on top of this. The result, at first glance, looks more like a radio

telescope than an optical one principles. They're both built around a large capturing as much light as possible from objects that may be on the very edge of the observable universe. In essence, the bigger this mirror is, the better. In Hubble's case the mirror is 2.4 metres in diameter, made from a single circular piece of glass. If this was scaled up to the size needed for the JWST around 6.5 metres across - then not only would it be extremely difficult to fabricate

18 hexagonal segments: these can fold up for launch and then deploy into an operational configuration once in space. Although NASA considered making the segments from glass like Hubble's mirror, in the end they used beryllium, a very strong, lightweight metal



PRIMARY MIRROR .-

Made of 18 hexagonal segments each 1.3 metres across, this collects as much light as possible

SECONDARY . MIRROR

diameter, this reflects the focused image



INSIDE AN ORBITING OBSERVATORY

The JWST is both a



for the main mirror. That's around 2.7 times

as big as Hubble's, but the actual greater than this. That's because the light-collecting power of a mirror is its diameter. Allowing for the hexagonal shape of the segments and the hole in the centre, the effective area of Webb's mirror is 25 square metres, compared with

four square metres for Hubble. That equates to a performance improvement

commonly employed in high-speed aircraft and space vehicles. This needs to be shaped and polished to extremely high accuracy in order to produce images with the Did you know?

After achieving the desired shape. the mirror segments were then coated with a thin layer of pure gold to maximise reflectivity at infrared wavelengths.

during ground test

When all the segments are put together

INTEGRATED SCIENCE INSTRUMENT MODULE (ISIM) ELECTRONICS COMPARTMENT the primary mirror, which has a hole in the centre to let light through RACKPLANE This sturdy structure has to carry its science instruments -2.400 kilograms in total SUNSHIELD

* SOLAR PANELS

Pointing towards the Sun, these provide electrical power for both the spacecraft bus and the science instruments.

COMMUNICATIONS ANTENNA

Pointing towards Earth, this receives commands from the Operations Control Centre and sends science data back to it.

SUNSHIELD

SPACECRAFT BUS

power, data handling and communications, as well as rocket thrusters for orbit correction.

Located at the L2 point, the JNST will sit in constant bright sumshine. This is healthy for the egipment in the speachers that, but had men for the epicial instruments and science module. Because they observe in the infrared, they need to be lept as cotical as possible in order to handow correctly. The two halves of the speachcraft will be separated by a hape, little-shaped, fleve layer sunshield. ZI methes long by IA wide, which is roughly the size of a termin court. While the sunifission may reach temperatures of 100 degrees. Celsius, the cold side will be as low as 1237—140. If degrees alone absolute zero.



Launch and DEPLOYMENT.

There's a perfect spot in space for an infrared telescope, and Webb is heading there

A key feature of Webb's design is that it has a 'cold side' and a 'hot side'. The cold side is the one that does the observing, while the hot side carries the spacecraft's solar panels and an antenna for two-way communication with Earth. But this arrangement only works if the Sun and Earth are always in the same

direction from the spacecraft's point of view.
This wouldn't be the case if it was simply placed in Earth orbit like Hubble, nor would it be true if the spacecraft orbited the Sun at a slightly different distance from Earth's

distance at which an object can orbit the Sun and always see the Sun and Earth in the same direction. This is the so-called L2 point, and it's where the James Webb Space Telescope will operate.

Ideiscope will operate.

Ze is one of several locations called
Lagrange points, after Joseph-Louis
Lagrange, who studied them in the 18th
century. At these locations, the gravity of two
massive bodies – in this case the Sun and
Earth – conspire to keep a third, smaller
body, such as an asteroid or spacecraft, in a

These Lagrange points aren't stationary, but they revolve around the Sun at exactly the same rate as Earth, so their distance from us always stays the same, in the case of L2, it's around 930.000 miles away —

around four times as far away as the Moon. To get the tiescope all the way out to L2 requires a powerful Isunch vehicle, which will be the European Space Agency's Ariane 5 nocket, In just 26 minutes following liftoff from French Quana, this will carry Webb free of Earth's stimosphere and put it on occurse for L2. The spacecraft will then separate from the rocket and cruise for around a month before finally arriving at



30 MINUTES SPACECRAFT SEPARATION

accelerate Webb to faster than the Earth's escape velocity so it can travel straight to L2 without entering

34 MINUTES SOLAR PANELS DEPLOY

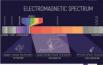
A number of key systems looked during launch will be released, including the all important solar panels that provide the spacecraft with its electrical names.

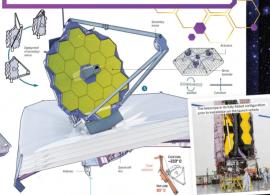
THREE DAYS SUNSHIELD PALLETS DEPLOY

After a couple of trajectory corrections, the main deployment will start halfway through the first week. The first major step is to unfold the nallists holding the sunshield.

ILIHY INFRAREN?

We normally this of attractory in terms of visible light, because that's what our years all traditional depresses see that attractional depicts produce season that what our years and traditional depicts produce represent a second control of the depict of the produce of the second control of the depict of the second control of the depict of the depict





SIX DAYS

The spacecraft bus and the optical assembly will move two metres farther apart, allowing room for the surshield to deploy fully in the space between them

TWO WEEKS

FINAL CONFIGURATION
The spacecraft will be fully deployed, with
the primary and secondary mirrors looked
in place. As it completes its journey to
the property of software and the state of the second learning of software and the state of the second learning of software and the state of the second learning of software and the state of the second learning of software and the second learning second

FINAL ORBIT 932 000 MILES





1THE EARLY

Because light from distant objects travels at a finite speed. we see things as they used to be in the nast. Hubble has shown us galaxies as they were many hillions of years ago, but the JWST will be even more sensitive. NASA hopes it will see all the way back to when the first Did galaxies formed. you know? around 13.6 billion upars agn. Recause The JWST's the universe is expanding, light from distant objects is etrotohod out increasing its wavelength This means light emitted in the visible waveband actually

reaches us in the infrared

ize comparison of Hubble (left) and the JWS howing full view (top) and mirrors (bottom)

2 GALAXIES OUFR TIME

Thanks to Hubble, we know what galaxies look like - collections of stars, often arranged in elegantly symmetric spiral patterns. But these tend to be relatively nearby galaxies, and hence mature ones. The glimpses that Hubble has provided of very early salaxies's.

suggests they are smaller and scrappier. No one with the smaller and scrappier. No one smaller and scrappier. No one smaller and scrappier. So formed or how they clumped together to produce the larger, regular-looking

galaxies we see today.
It's hoped that Webb will
be able to answer questions
like these with its ultra-deep view
of the early universe.

JWST SCIENCE Q&A

We ask NASA's Dr Mike McElwain about

What sort of science will the telescope do in its first year? In the first year, Webb's observing program will run the cosmic gamut from the first light in the early universe

interesting objects in the universe with a combination of improved resolution, sensitivity and wavelength coverage. This will enable new and enhanced characterisation of the femous objects in the sky. If you can game it. Withhis la-

What are the most exciting discoveries the JWST

make who of seel and oppose woods in make a year of the number of earlier by the seel proceedings of the process of the seel proceedings of the grant size as and eligible as helping up to a number of grant size as and eligible as helping up to a number of grant size as and eligible as helping up to a number of grant size as and eligible as helping up to a number of grant through and the massive doubted field at that are caused to seel the grant size of the seel to a number of size and eligible grant are as the grant size of the seel of the admissible of entire size of the seel of the admissible of entire size of the seel of the admissible of entire size of the seel of the seel of the admissible of the seel of the

Do you think that Webb will become a household name like Hubble? It half yeeper around the globe will be discussing Webb imagery while stiting around the dinner table. Smain or hubble. Webb will produce spectacular images of the commiss that will captivate the imagnation. We are table to see the product of the the programment of the product of the product of the product of the product of the artificial terms of the mental rathe.



Michael McElwain is JWST observatory project scientist at NASA's Goddard Soace Flight Century

3 LIFE CYCLE

DESTARS Stars are born, develop, age and die and the remnants of old stars contribute to the raw material pooded to make now stars Much of this process is well understood, but there's still a mystery surrounding the actual birth of stars, and the planetary discs that may form around them. That's because these are initially enveloped inside a cocoon of dust, which ordinary telescopes using visible light can't penetrate. But all of this dust will be virtually transparent at the infrared wavelengths used by Webb, so NASA hones it will finally reveal the ultimate secrets of star formation.

4 OTHER WORLDS

One of the most exciting areas of astronomy is the search for exonlanets particularly Farthlike planets that may have conditions for life to evolve. The IWST will use infrared imaging and spectroscopy to study the chemical and physical properties of planetary systems. Its ability to peer through dust and snap high-resolution images should provide us with a direct view of planetary systems in their very earliest stages. Webb will also analyse the chemical composition of expolanet atmospheres looking in particular for telltale signatures. of the building blocks of life.

JWS J by numbers

Although
operated
by NASA,
the JWST
was built by
Northrop
Grunnan



Webb's sunshield has a Sun-protection factor 50.000 times higher than high-SPF suncream

0.001 Webb's gold coating is 1,000 times thinner than the width of a human hair Number of infrared space telescopes prior to the JWST

EARS Webb has a reasonably



6,500 KG

Total mass of the spacecraft – around the same as four family cars 4,843

Confirmed exoplanets as of October 2021

The electrical power generated by the solar panels is enough to power a small home

ALLTHE DATA FROM WEBB WILL BE PUBLICLY AUPILABLE ONLINE 1,200

Hundreds of people were involved in designing and building the JWST

WERR COULD DETECT

It will be half a year from launch to the first full-quality images

ONCEPER LIKE EART

\$837

s total post-launch operations budget

half the sky at any time

A huge amount of data can be downloaded each day

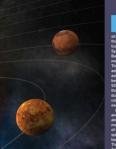


been many successful launches of Ariane 5 before the JWST

10

Why do the eight planets of the Solar System orbit on the same plane?

WORDS JOANNA WENDEL



f you've ever gazed at a moo of the Solar System, you've likely noticed that the Sun. Interpretation of the Solar planets, moons and asterior, at 7 to answer this question, we have well to the very beginning of the Solar sitem, about 4.5 billion years ago. act then, the Solar System was just a assitive, spinning cloud of dust and gas and massived cloud measured 12.04 and assisted massive cloud measured 12,00 nomical units (AU) across. A si nomical unit is the average dist astronomical unit is the average distance between Earth and the Sun, or about 93 million miles. The cloud became so big that even though it was just filled with dust and gas molecules, it started to

se and shrink under its and gas started to collapse, it ins, the dough expands, but That's what happened to the very early Solar System. Meanwhile, in the centre of this ever-flattening cloud, all those gas

molecules got squeezed together so much that they heated up surroundings and burping out waves of

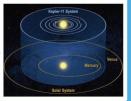
owing Sun cleared out a dought only space around it. As the Sun grew, the cloud continued flapps, forming a disc around the star at became ever flatter and continued pand, with the Sun at the centre, entually, the cloud became a flat ructure called a protoplanetary disc, bitting around the young star. The pretiched hundreds of AU across and w. ens of millions of years thereafter, the dust particles in the protoplanetary disc rently swirled around, occasionally stuck together. Over those millions of

ntinued to collide and

ally, most of the material in the protoplanetary disc stuck together to form huge objects. Some of those objects grew so big that nets, dwarf planets and moons. Other jects became irregularly shaped, like asteroids, comets and some smaller same plane where their building the Solar System's eight planets and other celestial bodies orbit on roughly

SIMILAR SYSTEMS

Our Solar System isn't unique. There are more than 3,200 stars in the Milky Way known to have planets orbiting them. One of the 'closest' examples is over 2,000 light years away from Earth: the Kepler-11 planetary system. Kepler-11 is the system's central star - a vellow dwarf star which is similar in size to the ice giants Uranus and Neptune. There are six known planets in this. system, all of which orbit much closer to their star than most of the planets in our Solar System. The closest is Kepler-11b. which is around ten times closer to Kepler-11 than Earth is to the Sun. The outermost planet is Kepler-11g, orbiting its star from around 43 million miles away. which would place it between Mercury and Venus in our Solar System.



ORBITING THE SUN How the major bodies move through the Solar System



bula, causing hydrogen atoms at the uclear fusion. This resulted in the





MERCURY

DISTANCE FROM SUN

ONE ORBIT:



DISTANCE FROM SUN

ONE ORBIT ORBITAL VELOCITY:



ONE ORBIT: ORBITAL VELOCITY:

ONE ORBIT: ORBITAL VELOCITY



DISTANCE FROM SUN

ONE ORBIT



ORBITAL VELOCITY:



DISTANCE FROM SUN

DISTANCE FROM SUN ONE ORBIT: ORBITAL VELOCITY:



ONE ORBIT:

ORBITAL VELOCITY:

SATURN

DISTANCE FROM SUN



BUILDING







began to clump togethe nder the gravity of the newly formed star.

SHAPING THE SOLAR SYSTEM How a cloud of dust created the Sun, planets and their orbital order

PUSHED OUT wdrogen and helium, were moved wards by the solar wind, leaving only

heavier materials, such as rock,

Rocky clumps began to

collide and form spheres, which were ultimately rounded off int the planets of the Solar Syste

This natural phenomenon keeps planets in orbit and our feet on the ground

WORDS ADAM MANN

ravity is one of the four
fundamental forces in the universe

the others being electromagnetism and the strong and weak nuclear forces. Despite being all-pervasive and important for keeping us from flying off the Earth's surface, gravity largely remains a puzzle to scientists. Ancient scholars tryine to describe the explanations for why things fall towards the ground. The Greek philosopher Aristotle maintained that objects have a natural tendency to move towards the centre of the universe, which he believed to be the middle

of the Earth.

But later luminaries dislodged our planet from its primary position in the cosmos. The Point polymath Nicolaus Copernicus realised that the paths of the planets in the sky made.

Parties and the Sun was the centre of

much more sense if the Sun was the centre of the Solar System. The British mathematician and physicist base Newton extended Copernous Insights, reasoning this flyended Copernous Insights, reasoning this flyended sense of solar of struction on one another in several force of struction on one another in his temous 1687 treatise Philosophiae Naturalis Principle Mathematica, Newton described what is now called his law of universal gravitation.

WORLD A STATE OF THE STATE OF T

Gravily is the weaks of the forces. A bar magnet will electromagnetically juil appear eliq upwerf, overcoming the gravitational force of the entire gravity is offered to a consideration of the control of the control

value of C, the gravitational constant. Cavendish built what's known as a torsion balance, attaching two small lead balls to the ends of a beam suspended horizontally by a thin wire. Near each of the small balls, he placed a large, spherical lead weight. The small lead balls were gravitationally strated to the heavy lead weights, causing the wire to twist just a tiry bit and allowing him to calculate O.



A model of Cavendish's torsi balance experiment

EINSTEIN'S GENERAL THEORY OF RELATIVITY Granty's effect on the Solar System

you know?

LARGEST OBJECT
Making up 99.8
per cent of the Solar
System's mass, the
Sun has the strongest
gravitational field.

STRENGTH VARIATION

The Sun's gravitational pull is stronger when planets are closer to it. This means planets at the centre of the Solar System



EARTH'S GRAVITY

natural satellite, held in by the planet's gravi



elativity showed that gravity arises from the curvature of sce-time. Even rays of light are it as they follow this curvature.





thout the Sun's itational pull. This it causes them to ravel in orbits.





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MEET THE

These tiny amphibians are both colourful killers and dedicated parents

WORDS SCOTT DUTFIELD



found living in the tropical rainforests of Central and South America. Poison dart frogs were given their name because toxins secreted from their skin have been used to tip hunters' arrows. The indigenous Emberá and Noanamá Chocó of western Colombia have used the skin of the golden poison frog (Phyllobates terribilis) to tib blowgut darts for hundreds of years. These vibrant amphibians come in all colours of the rainbow. Their elaborate colourings work as an early warning to predators that they are poisonous, so an attempt to eat them would be a mistake. This survival mechanism is called

predator that an animal is dangerous or bad tasting. Butterflies also employ this technique to stay safe. Dyeing poison dart frogs (Dendrobates finctorius) use their bright vellow

camouflage in their natural habitat.

The variety of colours among poison dart frogs may be due to a separation in the

opulation of their evolutionary ancestor around 10,000 years ago. The flooding of modern-day Panama thousands of years ag may have driven ancient frogs to various locations around South America, where

they evolved their own colouring and body patterns. The toxicity of poison dart frogs differs in severity between species. However, all of the most toxic

d in species belong to the genus Phyllobates. Frogs in this genus secrete a potent toxin called

often labelled the most toxic batrachotoxincarrying frog, containing at least 20 times the amount of toxins than any other species in

SCIENTIFIC NAME

road to be the m



the dendrobatidae family. Batrachotoxin is a powerful steroidal alkaloid that interferes with the voltage-gated sodium channels in nerve and muscle cells. The brain sends instructive electrical messages to different parts of the body, which pass through these sodium channels. Batrachotoxins work to keep these channels open and disrupt the brain's messaging system, causing a whole host of debilitating and potentially fatal conditions such as paralysation, extreme pain

and even cardiac failure There is one animal that can withstand the poison powers of the golden dart frog. the

poison power of the golden darf freg the res Selled values (Light) expresspherity. This small regist is the only known redural seminary to the control of the control of the processing seminary to the control of the consists of inheteror is available to them, and as also seminary to the control of the CS through the deep that processing of the CS through the deep that processing the control length yellows and to which the control of th

consible for giving these frogs their son. For the more potent members of the family, it's been suggested that melyrid beetles might be the culprit. These beetles contain high levels of batrachotoxins and have been found in the bellies of pitohui birds, which have the same secreted poison as poison dart frogs

When raised in captivity, toxins are not obtained through their provided food, and therefore wild-caught frogs often lose the majority of their toxicity. Those bred in captivity lack any poison altogether



SCIENTIFIC NAME:

STATUS The dyeing frog can be found on the forest floors of Brazil and Guyana, This dual-toned frog gets its name from a technique

called tapirage, whereby the frog's skin is used by



As the frog with the lowes

amount of toxins in the Phyliobates family, this poison frog is the best of a alkaloid called niliotoxin. This toxin affects the calcium including the heart and







SCIENTIFIC NAME

STATUS:

Along with the golden dar-frog and the black-legged ison frog. Kokoe poisor rogs are one of only three species of frog to be used to tip the blowguns of Chorn tribes in western Colombia, Like its

poisonous cousins, the Kokoe poison from is laced in alkaloid toying that can



STOPPING SELF-SABOTAGE

noisoned when they consume their prey? There are many theories to explain the toxic resistance of these frogs. One is that their anatomy includes genetically mutated sodium channels that prevent the toxin from binding and affecting them. Another method, employed by many predators of poisonous animals, is to simply remove the toxin from the body quickly after consumption. However more recent studies have suggested that poison dart from have 'toxin sponge' protein molecules that prevent the batrachotoxin from binding with sites on the frog's cells. thus providing them with immunity

NURSERY

nursery for the tadpoles for the next few months, where they will undergo metamorphosis and become adults.

SYMBIOTIC

provided by their faeces

POISON PARENTS The life cycle of the strawberry

poison dart frog

COUPLING UP

Mating occurs throughout the year particularly during the rainy season, at a site been chosen by the male.



LAYING A frog's clutch can vary in size, but typically strawberry poison dart frogs will lay around six eggs. many as 40 eggs.

FERTILISING

leaf litter in a dark and dart frog species the male releases his sperm onto them for fertilisation.

ON GUARD Parent frogs will

guard their offspring for around ten days. occasionally watering them with their urine

POOL HUNT

back of their mother. along the sides of trees and tall bromeliad

plants in search of a pool of water



GLOBAL POLLUTION BY NUMBERS

Oil tanker accidents account for 10 to 15 per cent of all oil that enters the ocean each year



16.000 pieces

THE CHERNOBYL DISASTER'S LEGACY

35 years after the infamous explosion at the Chernobyl Nuclear Power Plant, radioactive fallout is still present, 58,000 square miles of land in Belarus, Russia and Ukraine remains classified as contaminated, and the 1.100 square miles closest to the power plant is considered an exclusion zone. In April 2020, fears about the levels of radioactivity in Chernobyl reignited when wildfires ripped through exclusion zone forests. This caused radiation levels to spike more than 17 times the normal background levels, as the burning trees released

previously absorbed radioactive elements such as plutonium-238 and caesium-137.





allution is the introduction environment that results in damage, interferes with

ecosystems or endangers human health. The word 'pollution' stems from the 14th century and comes from the Latin word 'polluere', meaning to soil or defile. However, it wasn't until the Industrial Revolution that the effects of human particularly the reduction in air quality

Since then, pollution has become one of the biggest threats to our environment, massively impacting the health of humans all over the world. Millions of people die prematurely each year from diseases caused by air pollution. For example, in the UK alone around 36,000 deaths. are caused by air pollution each year

Air quality is measured by the amount of those that are smaller than 2.5 micrometres (PM2.5). These fine particles are responsible for than 2.5 micrometres can enter the bloodstream

arteries. This has the potential to disrupt the functioning of the heart. Air pollution is just one of many different types of pollution, which all contribute to destroying our environments. Other forms include water, land and plastic pollution. compromise water quality and impact human health. It's estimated that 4 000 children die every day from polluted drinking water. Similarly, contaminated land waste, such as denosits in landfill sites or runoff from agriculture, can leach toxic chemicals into the soil system. These leachates then migrate through vegetation and enter the food chain.



Here are some of the most polluted places on Earth



NIGER RIVER DELTA

MATANZA-RIACHUELO ARGENTINA



AGBOGBLOSHIE





NORILSK RUSSIA

richk is an industrial oilly that was founded in 1995. It was be horse to one of the world's largest heavy metal smelting into I-februrally the oilly has been the source of large-scale lattice, with millions of formes of heavy metals such junc. I was a supplied on the control of the source of large-scale and, last and of even a serial criticated into the similar point of the control of the control of the control of lattice and the control of the control of the control of serial control of the control of the control of serial control of the control of the control of serial control of the control of serial control of the control of serial lattice and control of serial lattice and serial lattice serial seria



CITARUM RIVER

In the Wint John province of John In the Wint John province of John The International Conference of Land The International Conference of Land The International Conference of Land Land Francisco and Land Land Agency. The International Production Agency. The International Conference of Land Agency. The International Conference of Land washe and borough cover from Industrial has discreased by Edo or conf. Although the river is nightly polluted and provided benefit of bring to work to Standard, Door and Standard Conference of Land work of Standard, Door and Standard Conference of Land Standard Standard Conference of Land Standard Sta



The industrial day has the second worst as majority in the world. The streets of Grazadar, all with smoke due to Incustor, all with smoke due to Incustor. If we want to the street of Grazadar, all the streets of Grazadar, and the such streets of Grazadard, and the such shortest and and the streets of Integrant doubt we into de entropy in the streets of the streets



HAZARIBAGH BANGLADESH

led Hazaribagh Hazaribagh sa hotspot for chronium pollution with the same of the same of



CAMEL To the begin a part of the following the process of the part of the part

SPLITLIP

called a caravar

This mammal's unique features allow it to thrive in desolate lands

WORDS AILSA HARVEY

he its own biological survival bodopack, a camel's hump provided it with energy during polonyed periods of famine in barren environments. These distinctive protruding mounts store up to 36 klogaran of fat each. Depending on the species a, camel can have one, two or sometimes more of threse lifesaving adaptations. When camels are unable to find food of water and begin to run out of energy from their last meal, they extract energy, virtamins, minerals and come mobiliser from design of the contraction of the contraction of the design of the contraction of the design of the contraction of the design of design of

morans without earing, Instead of distributing their fat more evenly around their bodies, camels are the only animals that store it ingreat lumps. Without this even layer of insulation, heat can escape camels' bodies more easily, preventing their body temperature from nishir both high.

These animals bodies are failtered inswerth incit, of yhilabitat, marrier in sandy offer an animal in sealage of the same of the sealage of some of their earlier in the same of the sealage of some of their carrier light growth and the same of the sealage of the same of the sa





STOMACH CONTENTS
Sometimes carnels regurgitate their food to re-chew. This can help when digesting tough foods and sometimes allows for extraction of water they can get in desert lands. Their long small intestines have a large surface I) area to maximise water reabsorption into the body

WIDE FEET A carnel's weight is distributed evenly

A came's weight is distributed evenly across this relatively wide surface area. This makes the animal more stable.

> Did you know? Baby camels can walk within 30 minutes of being born

WHAT'S ON A

When food is limited, animals can't afford to be fussy eaters. Camels are herbivores and rely on desert shrubs, grasses and twigs. Their mouths are tough and able to withstand thorns, but their lips remain flexible enough to grab and break off food.

Their stomachs have three or four chambers, which can prolong digestion to thoroughly break down tougher meals. The increased surface area of the stomach means moisture in the plants they eat can be better absorbed before leaving the body. Eating plumps up camels' humps, and after a long time without food they will shrink.



Camels can eat cactuses by grinding sharp thorns on their mouth palate

CAMEL BEHAVIOUR Camels are social animals, ofter

traversing deserts in male-led groups. When greeting each other, they known to blow in each other's faces. Different noises are made when camels 'talk' to each other. These include moans and hums. When a female camel gives birth, she usually separates hereaff from the heart, he most before regioning the herd two weeks later. For the next 10 to 12 months she will produce milk grow to well produce milk of the year.



Female camels need to find enough food to produce milk for their young



ethods used in farming are constantly changing. In the 1950s, for example, the increased use of pesticides, herbicides and fertilisers drastically improved crop yield, becoming known as the Green Revolution, But arguably the biggest 20th-century agricultural development was the arrival of the tractor. These vehicles replaced the animal power we previously relied on. Machinery excelled in fields; tractors could carry more across longer distances for longer periods of time, and even turn the soil. Farmers no longer needed to use large swathes of their land to grow food for the working animals.

Tractors are evolving as new tools expand the boundaries of farming. Whether you're looking for technology that tackles a vehicle's speed, maximises the number of tractors that can work at once or limits wasted resources, there are many features to consider when choosing a tractor today.

manual labour, and as advanced machinery increases farmers' yields and farms grow in size, the workload increases as well. In recent years, autonomous technology has meant that vehicles and machines no longer need to be tethered to a human driver. Instead of every change in speed, steering braking and navigation being initiated by the farmer, intelligent

In the future, driverless machines are likely to take on different roles around farms, with people controlling and preplanning the vehicles' daily movements. Some farmers welcome these 'super tractors' as a way to increase productivity while they focus on managing the farm, while others prefer more traditional methods. What today's tractors are providing, however, is choice and versatility in farming

Above: GPS tracking is used to locate autonomous tractors

Opposite: A Fastrac Two's average speed is 135 miles per hour

Steel cylinders at the

centre of the tures

add strength, needed

when travelling at

high speeds

speeds of over 150 miles per hour

REDUCED SIZE Its beight is 20 centimetres lower than the previous

Fastrac model, with width reduced by



MASSEY FERGUSON

increased visibility with

EENDT 942 VARIO

CASE IH MAXXIIN 145 ACTIVEDRIVE 8

providing 24 different

VALTRA VERSU T254 SMART TOUCH

CASE IH OPTUM 300 CVX



BIG BUID

The biggest tractor ever built is the Big Bud 16V-747, Measuring 8.5 metres long and six metres wide, this king of the fields gained its title when it was first built in 1977, and has retained it ever since. When Big Bud's fuel tank is full, the tractor weighs more than 45,000 kilograms - that's six times as beavy as an elephant

The vehicle's sheer size means that Big Bud can farm three acres of land in one minute. While there were multiple Big Bud tractors manufactured, only one of the largest models was built. Brothers Robert and Randy Williams, who own Big Bud, used the tractor for cultivating until one of its tyres sustained irreparable damage and it was put out of service. The brothers restored Big Bud with new tyres. allowing the largest tractor to continue operation.

The Big Bud 747 was built in Montana



DRIVERLESS SPRAYER This raised machine stands on four narrow tracks and lacks a 560-litre spray tank. Its high stance means it can

avel along rows of relative

ELECTRIC AND AUTONOMOUS

Smarter and more sustainable tractors are transforming the

AUTONOMOUS TRACTOR

autonomous concept tractor. Without the need fo a driver cab, these tractors are compact and can be used with tracks or wheels.

SEE & SPRAY

different colouration as it scans fields. Water is targeted at green crops, irmiting any water that is wasted on the

CONNECTED TECHNOLOGY

A smart device such as a tablet – or built-in technology inside a driven tractor – can be used to track the progress and live location of the farm's operating tractors. This helps when monitoring

"Tractors are evolving as new tools expand th boundaries of farming

EFFICIENT HARVESTING OMINIDRIVE is new technology that can turn grain-collecting

vehicles into autonomous ones. Instead of requiring tw drivers, the grain cart can b programmed to follow the combine harvester and

automatically match its speed





per charge, spraying six can be preprogrammed or controlled remotely.















500 ERY READER!

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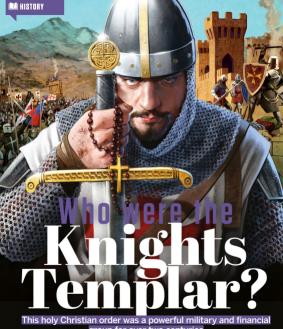
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group for over two centuries



Т

he Knights Templar was an order of devout Catholics founded in Jerusalem in 1118 CE, after the First Crusade. Also known as the Order of Solomon's Temple, it was created to

protect Europeans travelling to the Holy Land, among other duties. The knights were known across Europe as an elter flighting force with a strict code of conduct and, eventually, immense wealth. For nearly 200 years the Knights Templar were at the centre of politics and firstness ce in Europe, Listing part in Christian military.

campaigns in the Holy Land. In the seventh century, a Muslim Arab army compared Jenusalem and the Holy Land, ending Christian rule in the region under the Byzantine Empire, abo called the Eastern Roman Empire, By the end of the 11th century, the Byzantine Empire had best more terretory to Muslim invessions, including more Christian holy sites, in response, the pope called for the capture of Christian high sites in the Holy.

Land, beginning the First Crusade in 1096. A multinational army was raised for the Crusade, led by several of Europe's monarchs and nobility. The Crusaders succeeded in capturing not only

Jerusalem, but also much of the region.

The created four territories, known as Crusader States the County of Edessa, the Principality of Antioch, the County of Tripoli and the Kingdom of Jerusalem. These states were also known as Outremer, meaning "overseas", from the

French term outherner.

After most of the Chaudeers returned to Europe, there remanded a need to defend the Holy Land, as well as gowent spo poultance, which included Christians. Jews. Mustierns and new settlers from Europe. They needed to consolidate the ratio near settlers from Europe. They needed to variedly, But they didn't neelly have a consolidated state variety, But they didn't neelly have a consolidated state variety, But they didn't neelly have a consolidated state or policies they are that a certain runties of places they controlled were very easy for an enerty to infiltrate, and there was nothing really to keep law and order. It was these cocurristances that produced the femplers.

Knights decorated wi



GRAND MASTER

Unce selected, this person was the supreme authority of the Template for the rest of their life. Despite their power, many grand masters chose to fight, and even died in battle.

SENESCHAL They acted

as the advisor to the grand master and had an administrative role in the

MARSHAL

This was the leader of wars. The marshal was in charge of anything war-related, such as weapons.

COMMANDERS OF LANDS

Each of the lands had a leader who worked for the grand master. These commanders were in charge of the region's buildings and farms.

COMMANDERS OF KNIGHTS, HOUSES AND FARMS

were directed by the commander of their land but were responsible to a given city. This meant monitoring daily activities in specific communities.

KNIGHTS AND SERGEANTS Knights ranked slightly above

rgeants, but both fought in battles

They made up the majority
of the Knights Templar. Knights
could have three horses, while
sergeants were allowed just one.







Did

you know!

END OF THE ORDER

Once the Crusades were over and Muslim forces controlled Jerusalem, military orders, including the Templars, were blamed for the loss of the Holy Land. After the Mamiluks conquered the city of Acre in 1291, the Templars and other orders retreated to the Island of Cruns.

This prompted demands to reform the military orders. Philip IV of France, who was in huge financial debt to the Templars, ordered the mass arrest of French Templars on 13 October 1307, confiscating their property and wealth. Prosecutors charged the Templars with worshipping iddes,

spitting on the cross and kissing one another in their induction corremonies. Under torture, the Templars confessed to the charges. In 1306, Pope Clement V absolved the Templars of heresy, but the order and its reputation had already been damaged. In March 1312, Pope Clement V disbasanded the Templars as an organization, and the order's members were the templars as an organization, and the order's members were the last grand master, was burned at the stake in Paris on a charge of relappost hereory.

CHATEAU PÈLERIN

4,000 knights accupied this fortress

as it was near the sea supplies could be delivered more easily by fellow Templars.

TEMPLE MOUNT.
If temperature is the second s

Richard the Lippheart in 119

When Acre was lost in 1291

new Eastern headquarters

TEMPLAR

1 ALWAYS

2 NO FANCY

CLOTHES

3 EAT IN PAIRS

4 DON'T

5 NEVER DESERT



WHY THE CIVILISATION EGLLAPSED

What went wrong for this ancient South American nation?

WORDS OWEN JARUS

he Maya have lived in Central America and the flourishing in the region for thousands of years. The Maya civilisation collapsed between 800 and 1000 CE. But though the term the reality is far more complex

Just why did the Maya civilisation collapse, and can you even call it a 'collapse'? For starters, the Maya are still around today. It was the Maya political system that collapsed, not their society. The Maya region was large, with many environments, and multiple languages were spoken in

When the city of Chichén Itzá declined - largely because of a lengthy drought during the 11th century - another Yucatán Peninsula city called Mayapán started to thrive. Mayapán

had lords, priests, hundreds of religious hieroglyphic books, complex astronomy and a pantheon of day and from descendant populations who met and

While Mayanán declined prior to European contact, another Yucatán Peninsula site called Ti'ho was growing at the time the Europeans arrived. Maya states continued to exist even after the region was ravaged by wa and disease brought about by the European conquests in

MODERN MAYA

After the last Maya state was conquered by the Spanish in 1697, the Maya people continued on. enduring discrimination and at times resulting against Spain and the governments that came into power after Spanish colonial rule ended in 1821 This arrival brought about a profound change in the Maya world. New diseases decimated the Maya, and the Spaniants forced the Maya to convert to Christianity, even burning their books Today, despite the devastation they experienced

the Maya people live on. Although classic Maya cities and states did collapse, and culture did transform. the Maya didn't disappear. The descendant population of over 7 million in Mesoamerica now lacks adequate political representation in the countries where they live.



In Guatemala, Maya descendents make up over 40 per cent of the population





TEMPLE OF THE INSCRIPTIONS

King Pakal ruled Palenque for 68 years – the longest of any ancient Maya leader. When he died in 683 CE, his body was buried here.



REASONS FOR CITIES'

1 DROUGHT As rainfall der

to 70 per cent for ided periods, a and other crops agled to grow, thile drinking reservoirs

2 TRUST Maya

own power to deities. The problems the Maya suffered om droughts

caused the people close trust in their iters, which is more an just losing trust in e government when our rulers are closely at to deities.

3 TRADING

were unable to travel along them. This impacted the trade o goods between cities

4 POPULATION

Maya cities may have put a bigger strain on resources. As more land was cleared for the growing population, the region's ecosystem

5 INCREASED WARFARE

As archaeologists have studied Maya history, they've learned that these obies engaged in several violent wars. Hostility between large cities may have grown as resources became lose available.

→ BALL COURT

Ulama was a popular ball game played by Maya across Mesoamerica. The game involved keeping the ball off the ground without using hands or feet. "Not all Maya settlements were controlled by a king or an elite member of society."

ANCIENT LEADERS

The ancient Maya didn't have one central leader like an emperor in ancient Rome — and were not unified into a single state. Instead, the ancient Maya civilization consisted of numerous small states each control around a city. While these city-states share disministries in culture and religion, they each that some more powerful than others.

Not all Maya settlements were controlled by a king or an elite member of society. At Joya de Cerén, a Maya village in El Salvador that was buried by a volcanic eruption 1,400 years ago, archaeologists found that there was no elite class in control, and the village seems to have been managed communally, perhaps by local elders.

There was no single collapse for these polities; a number of Maya cities rose and fell at different times, some within the 800 to 1000 CE time period, and some afterward. For example, while areas in southern Mesomerica – a cultural region that forms the southern tip of continental North America – such as Tikal in what is now Guatemala, declined in the eighth and nith centuries due to environmental problems

and ninth centuries due to environmental problems
and political turmoil, populations rose in other areas,
such as Chichén Itzá on what is now the Mexican
Yucatán Perinsula.

INSIDE BATH'S ROYAL CRESCENT

The curved row is very striking

_ LADY'S

Discover the history and architecture of this beautiful Georgian street

WORDS AILSA HARVEY

A WEALTHY GEORGIAN HOME

No. 1 Royal Crescent

WITHDRAWING ROOM Evening entertainment was

moved to this floor after dinner. This room was a place to drink tea and relax.



DINING ROOM This was an area for entertaining quests

Objects placed in this room were often intended to show off the owner's wealth.



a concealed entrance, which servants were restricted to.

In Charles Dickens' The Pickwick Pagers, Mr Pickwick stays in the Royal Crescent

ha city of Bath in Somerset England is famous for its golden stone huldings quaint robbled streets and Roman baths. While Bath became a sna when the Romans built the baths in 60 CE its popularity only surged as a spa town during

the Georgian era. During this time, many of Bath's picturesque buildings were built.

This curved row of 30 terraced houses was designed by architect. John Wood the Younger and built were targeted at middle-class city residents. Although they didn't have the money to afford a large mansion in the countryside, the new residents wanted to live in a luxurious city dwelling. The original owners were allowed to personalise the interior build of their new homes, meaning that no two houses in this

sweeping crescent have an identical layout. The Royal Crescent is over 150 metres long designed to be an onen space for the residents

This grassy area previously held grazing

Evestock and was used to grow food when it was Imited during World War II. A fence and ditch - called a ha-ha - separates this private Park. This also helped to keep

you know?

Architect John Wood the

Royal Crescent while his

Younger designed the

father John Wood the

nearby ring of houses.

Fider designed the

called the Circus



The majority of Georgian buildings in Bath are made from the same stone

BUILDING HITH BATHSTONE

The honey-coloured stone that makes up the Royal Crescent is known as 'Rath stone' In the Jurassic Period which ran from 201 to 145 million years ago, the land that Bath sits on was underwater. As calcium carbonate grains moved across the seafloor, they combined with the inorganic mineral lime. Sediment continued to fall in layers, putting pressure on the rock

and producing limestone This made the perfect building material for the Royal Crescent and many other buildings in Rath, because it's a freestone: it formed from tiny grains of minerals and rock, so the stone can be cut easily in any direction without it breaking into distinct layers like other rocks

Architect John Wood worked with entrepreneur Raiph Allen to source and utilise the stone from Comba Down, on the outskirts of Bath. This is where large amounts of Bath stone was extracted during the Georgian era. Allen owned these quarries and built a tramway to transport the stone to the crescent

SERVICE WING

used by servants. 9

EXTENSION

Architect John Wood, who part-owned the house by marrying the first owner's sister, added an extension to it in 1769

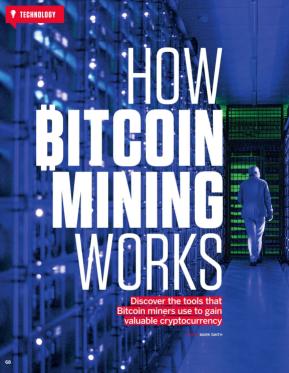
> COLLECTION CARINET

ural history. Thes

GENTLEMAN'S ROOM In the 1700s, men often had a room tailored to their interests

There they could read or work.

THE PARLOUR This was a family room and private space. Breakfast took place here as an informal meal



sses of servers are u

t was in the late-1800s that hundreds descended on the Klondike in Canada to mine for gold. It was known as the 'gold rush', and some of them found their fortunes. Many didn't find anything at all - and over a century later people are trying the same thing. But this 'crynto mining' and since the launch of the first cryntocurrency Ritcoin in 2009 more and mining it and other virtual currencies. You may have heard of Bitcoin, but there are many more cryptocurrencies out there - over 5,000, in fact Cryptocurrency is virtual money. Unlike ordinary cash, which has its value controlled by governments and banks, crypto is stored on something called a virtual ledger, which is like a database - a computer program for recording

the transaction is stored on something called a 'distributed leigher,' also called a blockchain. Whereas an ordinary database can be changed by one person, lots of people have access to that one distributed ledger. This gives the information stored on it – such as the fact someone has paid for something with Blotonvery difficult to false or make inaccurate. The transaction can be 't noted' to have really

taken place, giving the virtual money real-world value. These bits of information, which are added to the blockchain, are called 'blocks'. The back works this way shormeans crypto in not controlled by any shormeans crypto in not controlled by any old on the conganisation, bank, government or individual but by the community but uses. Other that transaction is agreed, it can be used to buy goods and services, but their the relief to buy goods and services, but the in the real work in a control of the contro

EASTUS WEST

Twitter founder Jack Dorsey wants to make it easier to mine crypto

The race to mine crypto has seen the balance of power shift back and forth between nations in recent years. The most recent development saw the US overtake China as the country with the largest amount of Bitcoin mining. The figures demonstrate the impact of a crackdown on Bitcoin trading and mining launched by the Chinese povernment in late May 2021, which devastated the industry and caused miners to shut up shop or move overseas. Other major mining operations are centred around Russia and Fastern Furone, with mining farms that are truly vast in scale



There has been a major crackdown on Bitcoin in China



TECHNOLOGY

Did There are a few reasons that people you know? use crypto. One is that it's semisimple to use and can be transferred between a buyer and a seller quickly online, Also, its value doesn't change depending on what's happening in any one country such as rising interest rates or job

losses. In Sentember 2021. Fl Salvador became the first country in the world to adopt Ritcoin as The creation of Bitcoin is referred to as 'Bitcoin. mining, and it involves adding new blocks to the

blockchain. The people who do this are all taking part in a worldwide competition known as the 'mining race' - think of it as a 21st-century gold rush. To take part, miners have to use specialist hardware known as mining rigs. This is computer equipment that creates new blocks to be added to the blockchain. It does this by solving complex mathematical problems. If they're successful they can get two types of rewards

The first is the block reward, which is issued to the publisher of every block. Think of it as a pat on the back for a job well done. The second reward is a transaction fee - fractions of Bitcoins paid by a private user who is making a transaction. This fee helps incentivise the miner

big players now rather than individuals. The biggest Bitcoin mining rig is said to consist of application-specific integrated circuit computers But miners with smaller operations have turned their hand to other country such as Ethereum and 7/lina The price of Ritcoin immediacently when Square CEO, lack Dorsey - who also founded Twitter - said that he wanted his digital navments company to build software which would make it easier for everyday people to mine crypto. He tweeted: "Mining needs to be more distributed. The more decentralised this is, the more resilient the Bitcoin network becomes."

MINING RIGS

can be the size of a desktop computer or truly yast, taking un entire buildings

GRAPHICS

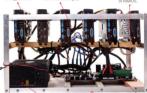
CARDS Linked graphics cards provide the computation power behind the mining process.

RISER CARLES

graphics cards to the motherhoard and allow spacing between cards to stop top

ODEDATING CVCTEM

Each rig has an operating system. or something like



"Miners have to use specialist hardware known as mining rigs

POWER SUPPLY Pretty much the same as you'd find on a desktop PC, this keeps the whole ris

MOTHERBOARD/CPU

Like a PC, the motherboard and CPU are the brains of the whole rig, allowing it to regulate its components.

This case is what keeps everything in place, and should be open to the air to allow

METAL FRAME

MINING'S COSTTO PLANET FARTH

some countries

Bitcoin mining is having a detrimental impact on the environment, say some experts

Traditional types of mining are known for their potential to negatively impact the planet, and Bitcoin mining is no different With vast amounts of energy needed to power computerised ries, it's thought the total amount of power needed to mine Ritcoin worldwide is more than that used by

In the last year, the total crypto-mining nower consumption spaced to the equivalent of the annual carbon footprint of Argentina. A single transaction made with Bitcoin has the same carbon footprint as 680,000 Visa transactions or 51,210 hours of watching YouTube, Benjamin Jones, a professor of economics at the University of New Mexico. said the amount of electricity used to mine Bitcoin "has historically been more than [electricity used by] entire countries, like Ireland".







process is so complex, those who do it successfully are given a reward in Bitcoin.

TECHNOLOGY

WORDS All SA HARVEY

FOLDING ELECTRIC BIKE

How It Works takes apart the Xiaomi MiJia OiCvcle

train with a bike can mean navigating tight aisles challenge. The OiCucle gets around this by transforming into a the handlebars turned upside down and the frame can be folded in half lengthways

Folding bikes have been around for over a century, but electric versions have only emerged in the last two decades after improvements in battery design. The combination of human pedal power and electric power makes longer bike rides achievable for people of nearly any age or fitness level. People can travel farther and faster with electric bikes, and can choose when to turn on electrical pedal assistance to suit their needs. With both electric and folding qualities, the OiCycle makes it easier to travel with and on the bike.

The OiCycle has small wheels - a common feature with folding bike models as it limits the width of the bike when folded. In non-electric bikes, a smaller wheel size would mean the rider would have to work harder over long distances. On an electric folding bike, though, each push of the pedal triggers a motor that propels the rider forward with ease.

ALUMINIUM FRAME The aluminium skeleton weighs 5.5 kilngrams. This makes up about a third of the bike's weight

COMPACT COMPONENTS

RATTERY

The hike's battery capacity is charged in three hours.



SPEED SENSO

rotations and activates the motor





The OiCycle has small 40-centimetre wheels





ELECTRICAL WIRE Inside the aluminium casing, this

wire connects all the electrical

CONTROL UNIT

The brain of the bike takes energy from the battery and directs it to the motor, it also connects to the pedals, display and

NEXUS THREE SPEED HUB

Gear shifting changes the level of electric assistance used when pedaling. More electricity increases the power produced by the motor per pedal.





BUILT-IN COMPUTER

To set up the Xiaomi MiJia QiCycle's computer, you first need to download the QiCycle smartphone app and scan the barcode shown on the computer with your phone camera. This synchronises details such as the time to match those on your phone.

As the rider starts to pedal, the speed of the bike will automatically display on the computer screen in real time. Using the arrows on the computer, the level of electrical assistance can be altered. The bike has four modes: enhanced, balanced, eco and off. Enhanced mode has the highest power assistance, while the 'off' mode uses no electricity. Holding down the up arrow turns on the bike's

The accompanying smartphone app displays extra information such as calories burned while riding, the bike's battery level as a percentage and the distance travelled on the bike. While the built-in computer is best for monitoring live performance while riding, the app stores the bike's historical data

lights when cycling at night.

Battery level, speed, distance and power can be viewed on the bike computer













MOTOR The motor has an output of 180 watts





WAS FLAT?

Eight ways our world would get weird if we really lived on a disc

EDS DAISY DOBBUEVIC



After all, there are many out there who truly believe that this is the case. How would everyday life function? Would it function at all? Here we explore how much of an oddball — or 'loddslice' — Earth would be if it were flat and whether there are any advantages to living on a strange disc with the Sun and Moon rotating overhead like characters on a cosmic carousel.

NO MORE AURORAE, AND WE'D ALL BE ROASTEN

surrounding our iron core generates electric currents which in turn create our protective magnetic field, curving around the planet from one pole to the other But on a flat Earth, without a solid core generating a magnetic field, we would lose our protective layer. called the magnetosphere. Charged particles from the Sun would no longer interact with our

shows. Though the absence of aurorae would be the with harmful solar radiation that could strip Earth of to our neighbour Mars

naut Jack Fischer aboard the rnational Space Station

HURRICANES WOULD BE A THING OF THE PAST

Every year, hurricanes, formed over the North Atlantic and Northeast Pacific: typhoons, formed over the Northwest Pacific, and cyclones, formed over the South Pacific and Indian Oceans, cause unprecedented damage. In 2017 Hurricane Harvey alone caused \$125 billion (£90 billion) worth of damage in the US.

The devastating rotating nature of these tropical storms stems from Earth's Coriolis force, which causes those in the Northern Hemisphere to rotate clockwise and those in the Southern Hemisphere to rotate counterclockwise. However, on a stationary, flat Earth, no Coriolis force would be generated. No Coriolis means no hurricanes. typhoons or cyclones. This is also why we don't see these storms between five degrees north and south of the equator, as the Coriolis magnitude is zero at the equ

EVERYONE WOULD SHARE THE SAME VIEWS OF THE NIGHT SKY

night sky would look the same wherever you were in the world. It is use would make stargazing easier, as unu wouldn't have to travel to a different hemisphere to tick off all the targets on your astronomy bucket list. But isn't that all part of out on the many discoveries that have been made through our enjoyment of a 360-degree view of the observable universe.



VISUALISING FLAT EARTH

TREST SCANHER

What would a flat world look like

WE'D HAVE NO Atmosphere



With no gravity, flat Earth would no longer be able to hold onto an atmosphere. Without our planet's protective blanket our skies would turn black, and surface life would coass to exist.

Water would boil sway in the vacuum of space, and surface temperatures would space, and surface temperatures would plummet. But is in fall bad news. Deep occan-dwelling organisms that don't require oxygen (nanerobic bacteria) and those that don't need sunlight to generate food and energy (chemosynthetic bacteria) might just survive. After all, such bacteria have endured long trips in space and lived to tell the tale.

SIDEWAYS



ID PAIN IT I gravity pulled towards the centre of the planetary disc, rain, snow and other forms of precipitation would gravitate towards who North Pelo. Poly at the centre of the disc would dis in weather behave dis we know it on our spherical Earth — falling straight may be a single of the properties of the properties of the properties of the properties of the Willer would also follow towards the North Pelo. and wast, bulging cocars would collect at the centre of the planet, leaving procedure, no walter after the the centre of the planet, leaving procedure, no walter after the degles.

WE WOULD ALL Get lost

7

It's very likely that satellites wouldn't exist. If Earth were flat, as they would have trouble orbiting a flat plane. There are a number of satellite missions that society depends on that just wouldn't work." says James Davis, a geophysicist at Columbia University's Lamont-Deherty Earth Observatory." I cannot think of how GPS would work on a flat Farth."

We depend on Global Navigation Satellite Systems (GNSS) for everything from the GPS services on your phone to travel information and supermarket stock management to make sure produce arrives as fresh and as quickly as possible. And, critically, emergency services use GPS to locate callers from their phone signal – so satellite communications could possibly save your file.

It's hard to imagine a world without GPS. Suffice to say we'd be lost without it. On the upside, at least on a flat Earth we'd have the horizontal rain to point us in the right direction – or north, at least.

SAY GOODBYE TO GRAVITY... At 1 Fast as we know it



On spherical Earth gravity public equally from all sides on matter where in the world you are. FOR Earth to take the shape of a doci in the first place, gravity must be having on effect. If it did, it would some public between the properties of the properties of the properties to be a properties of the properties of the properties located gravity of all. Of prefixes a fail Earth would have no gravity at all. Of prefixes a fail Earth would locate gravity for plot the center of the doc, the North Pilos. The further away from the North Pilos, the North Pilos. The further away from the North Pilos would wreak havon worldwide. but all least the world long, cented the control of the properties of the properties of provided world in the properties of the properties of provided world in the properties of provided world in the world long.

SOME JOURNEYS Wollin Take Forever

8

Larger have times would be expected, not just from gifting lost due to a lack of GPS, a till of the distance would need to have According to fail Earth basis the Avtoc less in the centre of the plant, and Affantica formers gaint to a wair around the plant, and Affantica formers gaint to a wair around the plant, and Affantica formers gaint to a wair around the unable to life you can be given and included are forced to life. The Affantica formers are the planting of the Affantica formers and the Affantica formers are for example, to life your own Affantia for which is not now side of the fall Earth may, to a part of Affantica formers are on the own they used in each of the Affantica formers. You cannot be a thick lectic. as well as North and South America. You cannot be affantial for the Affantica formers and the Affantica formers are also affanticated and the Affantica formers and the Affantica formers and the Affantica formers are also affanticated and the Affantica formers and the Affantica formers and the Affantica formers and the Affantica formers are also affanticated and the Affantica formers and the Affantica formers and the Affantica formers are also affanticated and the Affantica formers and the Affantica formers

WHAT ARE ANTIOXIDANTS?

The protective chemicals found in fruit, vegetables and other foods are lifelines to our health

JENN HALWEIL & SKYLAR WALTERS

Introordants are substances – and the prevent and slow cell and tissue damage by attacking free radical which are molecules that have an unpaired electron. Free radicals are natural byproducts of our metabolism and are also generated in response to environmental stranger, such as amongs in collision.

generated in response to environmental strapps or giper to mode. Dipulson, trapps or giper to mode. Dipulson, in high quantities, free radicals can cause outsidate stress, which is when the body has too many free radicals that start to destroy DNA, fatty tissue and proteins. This is where antioxidants can save the day. Unlike free radicals, antioxidants have sort a deer cons. This makes that they during his pass along the free radicals, antioxidants have sort an pass along the free radicals so they can no longer damage the radicals so they can no longer damage the

body's cells and tissues. In doing so, antioxidants ward off or slow oxidative str

preventing serious illnesses.

Oxidative stress has been associated with littlesses such as cancer, heart disease and some neurodegenerative diseases, including attherisms's and Parlismoris' diseases. The best way to increase antioxidants in the body and maintain a healthy balance of firer andicals is to incorporate antioxidant rich foods into your diet.



HOW DO THESE MOLECULES STABILISE OTHERS?

FAIRTONS Part decisions of Control of Contro

olds eight electro

COMMON ANTIOXIDANTS

considered an antioxidant. Researchers have discovered hundreds of substances that fit the antioxidant description, and there are bound to be thousands more. Vitamin C and vitamin E are two of the most

muscles after exercise. Carotenoids – a class of compounds found in Antioxidant carotenoids include beta-carotene, lycopene, lutein and zeaxanthin. However, taking high doses of some carotenoid supplements, such as beta-carotene, can increase health risks such as an increased chance of lung cancer in



vegetables and legumes, although they can be found in almost every food group. Fruits contain essential nutrients such as potassium, fibre an folate – nutrients that help maintain blood pressure, lower cholesterol and repair body tissues. Blueberries, remberries angles strawbarries and more are all filled with antioxidants antioxidants. Carotenoids are found red, orange or yellow vegetables. Many green vegetables such as kale toroccoli and spinach are excellent sources of antioxidants, namely quercetin and lutein.





UNSTABLE CELL When a molecule has an unpaired electron. its highly reactive state causes damage to proteins, DNA and

MORNAL CELL MOLECULE ELECTRONS BAD MOLECULE (





Learn about the layer of gas that surrounds and protects our planet

ADAM MANN

zone is a pale-blue gas composed of three bonded oxygen atoms. It occurs naturally high up in Earth's atmosphere, where it protects the surface from harmful ultraviolet rays - unless dissipated by natural or human phenomena. It's also considered a pollutant, with adverse effects for humans and other creatures when present closer to the ground. Ozone is a relatively unstable substance and can be destroyed by molecules containing nitrogen, hydrogen, giving them the first hints that there was a problem with the ozone laver

By the 1980s, researchers were able to map a yearly hole that opened in the ozone laver over Antarctica in the spring, though nobody knew its cause. In 1987, aircraft observations provided unassallable evidence that the ozone hole was being created by human-made pollutants called chlorofluorocarbons (CFCs)

chlorofluorocarbons and related compounds are highly destructive to gzone. A single chlorine atom can rupture more than 100,000 ozone molecules before it leaves the stratosphere CFCs come from industrial processes like

refrigeration and are used in fire suppression and foam insulation, among other applications. Scientists were able to find that ozone denietion wasn't just occurring over the South Pole, but also in areas over North America. Europe and Asia and much of Africa, Australia and South America. In 1987, countries around

the world signed the Montreal Protocol on Substances that Deplete the Ozone Laver, an international document committing signatories to addressing the ozone Ozone can be found in the phere in the form of smoo

POLLUTING THE FARTH'S SURFACE

When ozone is present down near the ground, it can be harmful. Such ozone. also called smog, is created from oxides of nitrogen (NOx) - emitted by cars, power plants, industrial boilers refineries and chemical plants combining with other organic molecules in the atmosphere.

Breathing in ozone can cause chest pain throat irritation coughing and damage to lung tissue. It's most dangerous to children and the elderly and those with nulmonary issues like asthma, emphysema and bronchitis. It is also harmful to vegetation and affects forests, parks and wilderness areas. Ground-level ozone can be reduced by limiting pollutants from cars and factories

A GROWING PROBLEM

the blue gas oznov







THE HOLE OVER ANTARCTICA

SEASONAL CHANGES The azone hale usually recovered by November when warmer weather

AVEDAGE THICKNESS

of the azone laver is

220 DORSON UNITS

ozone laver than 220 Dobson units to be holes.

DXYGEN US DZDNE

Molecular oxygen (O.) is the normal oxygen that we breathe, present throughout the atmosphere. It can be split apart by the Sun's rays into two single oxygen atoms, and one of these can then recombine with an O molecule to form O. - ozone.

The rar has a distinction and sharp adour reminiscent of chlorine and can sometimes be smelled after a thunderstorm, when lightning zaps oxygen molecules apart. This property is what gives ozone its name, after the Greek word ozein,

meaning 'to smell'. The vast majority of ozone sits in the stratosphere. Ozone makes up roughly 0.00006 per cent of the atmosphere, and peak concentrations of it are present around 20 miles above the surface in an area known as the ozone laver. At that height, ozone absorbs intense ultraviolet radiation streaming in from the Sun.



Without the ozone layer, the ground on Earth would be sterilised and life as we know it wouldn't be possible

TOTAL OZONE (Dobson units)

CREATED BY COLD

- those that form in the stratosphere.





WIDENING GAP

In 2021 the million square miles













This month we are giving you the chance to win one of two floating 3D Moon lamps. These celestial lamps use magnetic-levitation technology to float and spin in mid-air freely without any support or contact



For your chance to win, answer the following question:

How long does it take for the Moon to orbit Earth?

2 DAYS 0:10 DAYS 0:27 DAYS

Enter online at howitworksdaily.com and two lucky entrants will win!

rms and Conditions: Competition closes at 00.00 GMT on 16 December 2021. By taking part in this competition you agree to be bound by these terms and conditions and the report tion fluids of the resident agree to be found by these terms and conditions and the report tion fluids of the resident agree of 18 years for part. The winner will be desired a resident to a resident the conditions and the resident and the resident time of the resident time and time and the resident time and tim

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Term are conditions (Fig. 1), and 177.700.70 cm can be used before only the children's a solidate in the first of the children's an area of the first of the children's an area of the first of the children's and the children's and the first of the children's and the children's and the first of the children's and the





BRANDUMP Amazing answers to your curious questions



Did you know?



CAN PEOPLE REALLY 'WHISPER' TO ANIMALS?

Flora Mendoza There's no evidence that any sort of psychic or telepathic abilities gauge how some animals them - using body language. VW



WHYDO ROCKETS LAUNCHIN STAGES?

Kaci Sullivan A rocket has to lift its own weight as well as the payload it carries. This weight can be reduced by jettisoning stages when been used up. AM

computers keep getting faster?

Thanks to ancient Semitic miners. we now have our own alphabet

Who invented the alphabet?

4,000 years ago, a group of Semitic miners, who were sent by the Egyptian elite to look for turquoise, began scratching a simple form of writing into the rock walls. Rather than using complex images in the form of hieroglyphics as the Egyptians had done, the Middle Eastern miners created 22 simple symbols that could be combined in different ways to represent the words in their language - in other words, a basic alphabet. JE

MHOUNTHINDREMAR PULL DI PETTONSTO. F HOIL IT LINDKS MAGAZINF

BRAINDUMP

WHAT IS THE WORLD'S SMELLIEST SUBSTRNCE?

This question isn't as subjective as it sounds herause scientists can auantify the 'smelliness' of a chemical by how few molecules are needed for the human nose to detect it. In these terms, a group of sulphur. compounds called thiols are way out in front. In fact, tiny amounts of methanethiol are deliberately added to natural gas, which is otherwise odourless, so people can detect was accidentally released in the German city of Freiburg in 1889 AM



If you can be 'underwhelmed' and 'overwhelmed'. can you simply be



Dennis Railes

Yes, you can! The word 'whelm' is a verb meaning to submerge or engulf and is generally used to denote somewhere between being underwhelmed and overwhelmed. It originally referred to boats being capsized. but today we tend to use it in relation to our emotions. JE

WHYDOIGET BLISTERS IN

MY MOUTH?

A blister can occur on any soft area of the mouth, from the lip to the oesophagus, and there are many things that cause them. The most common way to get a blister is through injury. If you accidentally bite your lip or scratch your cheek irritated by strong toothpaste or mouthwash. Some acidic foods, such as pranges or pineapples, can trigger them. while others find that they get blisters if they are particularly stressed or generally feeling poorly. JE

Be careful when you take a bite.

WHY DO SOME STARS TILINKLEIN DIFFERENT COLOURS?

Abdi Shah Stars appear to twinkle because light from them is bent in different directions as it passes through the Earth's turbulent atmosphere. This bending effect, called refraction acts differently on different colours of light, so it can sometimes changing colour AM



ATOMS ARE THEREINTHE HMIUERSE?

Max Hall Scientists have actually calculated that number there are between 1075 and 10% atoms in the universe. That's ten quadrillion vigintillion atoms to a hundred thousand quadrillion vigintillion atoms. That's an insane number, but unbelievably it's trumped legal and illegal moves in a game of chess, which is up to 10¹²³, RR



schools, come racks are make of concreta. How many warks tory place to place, from about one road in 20 to rearly ball. There were 172 miles of concrete trunk reads in 2019 in the UK You can usually lett because they are much notiser than artimac. Concrete roads are elightly cheeper to maintain than tamosic, but driving on them feed how road builders lay them in sections that don't quite in together perfectly, in the US, concrete roads sound better because road builders grind



NASA is currently testing the Mars Ougen in Situ Resource Utilization. Department (AUCR) on Mars. 11 disregates ob produce origings from the Martian attemporare and works by failing in corbin disolids, which makes 100 floor cent of the figure of signature. The compartment of the 100 floor cent of the figure of the compartment of the Newest this is just a stepping stone to a few flung goal of having a human habitation NAMEs. After inhabitatis seed is ling set bendinging all human habitation NAMEs. After inhabitatis seed is ling set bendinging land in seed of the seed of the







WHATWAS THE FIRST INTERNET SEARCH ENGINE?

Millie Hayward In 1990, a tool called Archie helped to search internet sites for files. JumpStation was the firs world wide web search engine that behaved like modern search engines. Jaunching in 1993. AE



WHAT ARE THE PLASTIC PLUGS YOU SOMETIMES SEE INTREE STUMPS IN PARKS?

Leonard Parrish

They contain a herbicide called glyphosate, which travels through the stump to the roots. It prevents new growth - useful for invasive species - and causes the stump to ret away. Releasing the chemical directly into the stump minimises the risk of it harming wildfie or getting into waterways. W

ISTHERE A GASTHAT DOESTHE OPPOSITE TO HELIUM IFYOU INHALE IT? Bryan Clowland

bryan carevairs.

Helium makes your voice sound squaeky when you breathe it in because it's less dense than air—the same reason helium balloons float. That changes how your throat reconstes when you speak. Gases denser than air, such as sulphur headfluoride, instead change your throat's resonance to make your write delerned.



MHA DON, LAOR SEE OIT, CRIZHING, ONLOŁ OIT METT?

Annabel Cartwright
An oil well has a blowout, or
'gushes', when crude oil is
accidentally released too
quickly. Modern wells are
equipped with pressure release
systems which make incidents
for less likely to goour. #E





What is the 'damp' smell you sometimes get on clothes?

Akeem Guest

It comes from chemicals produced by bacteria and furgi in your clothes. There are many such chemicals because the common subsequence of the common subsequence of the common subsequence of the common subsequence of the common subsequence and furgit brive in damp, warm places, growing and multiplying, forming now bacteria. They were not the material in your clothes. The small is what the bacterial and furgit release after munching on damp fabric. bet drying laundry, or clothes that these getten was Att.

THE LIBRARY

THE SPACE BUSINESS

FROM HOTELS IN ORBIT TO MINING THE MOON

AUTHOR ANDREW MAY PUBLISHER ICON BOOKS PRICE £8.99 / \$16.95 RELEASE OUT NOW

Now that Becos. Mask and Branson the service of the

zone in the Sea of Tranquillity.
Or, if that's still too science fiction for you to swallow, low-orbit trips around Earth that are actually affordable to the average earner. May be some remote asteroid mining — and before you

The Space Business is easy to read, detailed and extremely well-researched

fiction: we've already landed a probe on a speeding comet and have another spacecraft targeting giant space rocks in the asteroid belt, the time of writing

the time of writing.

The point that opence writer and astronome for Anches May makes in The Space Backers in the Anches May makes in The Space Backers in the Anches May make which was not the season and the point of the Anches May make the Anche

From extraterrestrial tourism, to heavy industries like lunar mining for rare minerals and rocket fulls of harmessing the power of the Sun in enormous solar space arrays to solve the environmental disaster that is fossif-fuel energy generation on Earth: everything is covered. And don't forget the booming private industry surrounding those lucrative government space assence contacts.

agency contacts.

As an established author with several non-fiction books to his name and a regular contributor to How W Works, this My's area of experies. The Space Business is easy to read, detailed and extremely well-researched—and fascinating to boot. It's a no-brainer for anyone who enjoys the odd Brain of work observations and really for anyone who's interested in space, technology or business.



RSPB NATURE GUIDE:

TAKE A WALK ON

THE WILD SIDE

AUTHOR CATHERINE BRERETON
ILLUSTRATOR KATE MCLFLLAND

PUBLISHER BLOOMSBURY PRICE £8.99 / \$15.35 RELEASE OUT NOW

From woodlice and wildflowers to polecats and pike, this field guide covers all kinds of potential British wild encounters. There are more than 195 different animals, plants and other forms of

wildlife to discover and identify within the pages of this guide. Its bitesize format and withrant illustrations make this a great introduction to wildlife for any budding ecologist. This book is also a great transitional guide for a younger audience before they grow up and start using the RSPB's classes; more detailed field to uries.

Along with being a useful guide to the wild outdoors, this book also includes species that you might find in your back garden and offers tips on how you can best help to protect them. For example, cutting hedgehog holes in your fence allows these small mammals to travel from garden to garden safely.

BUGS FOR BREAKFAST

HELP SAVE THE PLANET

ALITHOP MARY POONE DUDI ISHED CHICAGO DEWIEW DDESS PRICE \$13.00 / \$14.00 RELEASE OUT NOW

Sustainability and the human impact on the environment have discussed among politicians, business our eating habits and the negative effects could farming insects offer a solution

Roone serves up an alternative view on eating insects and reveals their nutritional value, their culinary prevalence around the world and how they may offer a sustainable source of food - you might be we find inserts on unannetising Although certainly open the reader's mind to a



OCEANARIUM

WELCOME TO THE AQUATIC MUSEUM

AUTHOR LOVEDAY TRINICK ILLUSTRATOR TEAGAN WHITE PUBLISHER BIG PICTURE PRESS PRICE £25.00 / £37.99 RELEASE OUT NOW

world hidden under the sea. you. Designed as a virtual museum. there are eight sections to explore: plankton, cnidaria, molluscs and

echinoderms, arthropods, fish, mammals, birds and reptiles. You will also learn about the importance of the ocean as a open up this book, the diverse shapes and details of ocean life are a marvel as seen through the informative

annotated illustrations Author and marine biologist Trinick worded to incorporate a mesmerising fact or stat, with a 50/50 split of information and imagery beautifully complementing each other. It's a wonderful substitute for a visit to a

ALBERT EINSTEIN

LITTLE PEOPLE, BIG DREAMS

RELEASE OUT NOW

AUTHOR MARIA ISABEL SANCHEZ VEGARA ILLUSTRATOR JEAN CLAUDE PUBLISHER FRANCES LINCOLN CHILDREN'S PRICE £9.99 / \$15.99

When he was just a teenager, Einstein wrote his first scientific paper, going on to become one of the world's most famous and inspirational scientists. As the 69th book in the 'Little People, Big Dreams' series, this biography dissects Einstein's life and turns it into an illustrated tale. It's written for children of primary school age, who benefit from picture books. While average children's book - in order to pack in the main events of a fascinating life - the warm illustrations that cover every page provide the perfect intervals. Claude captures Einstein's iconic look and expressions from childhood through to old age, with each chapter of his life cleverly illustrated in captivating detail.



As Vegara takes the reader smoothly through explains some of the scientist's most complex understand. From his successes and awards to acceptance and peace, this version of Finstein's Ife teaches children positive takeaway lessons. It inspires young readers to be curious about the world around them while always considering the bigger picture

BRANGYM Give your brain a puzzle workout

Sudoku

Complete the grid so that each row, column and 3x3 box contains the numbers 1 to 9

EAS	SY.							
		9	7			2		5
					3		4	7
2	7	6	4			1		
1			П		4	Г	5	Г
9		5	8			4		6
6		4	5	9	2	8	7	
8	9		П	6	7			4
4				5	9		2	
			1		8		6	9
ME	DIU	1						
1	7			2		4	8	
							6	7
9		2	6					5
2			П		П		1	8
	6		1		5			
3		9	2		7		4	
	3		П	9			2	4
6		4	3		2	8		
		7		6				
HAI	RD							
4		2		5				
			2		8	1		
3	8	7	1	6				Ĺ
				2				
	2		5		1			3
							8	6
			9	8				2
		1				5	9	

Word search

Find the following words

WEBB CAMEL GRAVITY
TELESCOPE POISON POLLUTED
KNIGHTS MAYANN BATH
DOUBTIN DIST POIS

L	А	Ψ	P	E	M	J	F	0	N	0	5	1	0	P
R	Ι	В	R	G	R	A	U	1	T	γ	1	E	N	0
5	Q	W	Ē	В	В	C	R	Y	1	M	K	N	1	L
T	Ē	F	Ē	5	C	A	Ē	R	U	0	P	U	R	L
F	L	0	1	Т	Y	1	В	A	Н	R	Т	1	G	u
C	R	Ψ	P	Т	0	E	L	Р	И	Х	Ε	F	Н	T
G	А	R	u	N	A	Т	Н	Ē	C	K	L	J	E	E
U	1	Μ	K	N	0	N	С	L	M	0	Ē	R	1	D
E	Т	А	E	Y	P	5	A	L	F	A	5	P	N	P
5	0	N	1	L	T	E	Μ	0	В	E	C	Χ	A	E
K	N	E	G	Н	F	W	u	M	A	1	0	N	Y	T
В	E	Т	G	1	R	С	L	K	Т	Н	Р	J	Я	0
F	W	1	P	E	V	Y	Q	u	Н	0	E	K	Μ	В
0	N	Х	u	В	A	Н	T	C	R	Y	P	T	1	N
K	Ē	N	D	0	F	L	A	T	C	Н	A	Z	T	Ē

What is it?

Hint: Arguably the world's most famous timepiece

A



Spot the difference

See if you can find all six changes between the images below





Answers Find the solutions to last issue's puzzle pages OLROSWELL NEW MEXICO

Q2 A VIEW TO A KILL
Q3 JOSEPH STALIN
Q4 OHM
Q5 DECAYING VEGETATION
O6 NINTENDO







QUICKFIRE QUESTIONS

QI Which of these is the most

potent greenhouse gas? Carbon dioxide

- Carbon dioxid
- Nitrous oxide
- Fluorinated gases

Q2 Which 1934 invention made driving at night a much safer prospect?

- @ GPS
- Streetlights
- Cat's eyes
- Road markings
- Q3 Why do trees have bark?
- As defence against insects
- As defence against insec
- To reflect sunlight
 To deflect woodcutter axes

04 Which of these is the most

- Pray-2
- D-Wave Advantage
- The Difference Engine
 Macintosh 128K

Q5 What is infrared radiation also known as?

- Visible light
 Heat
- X-rays
 - Sound

Q6 Approximately how many Earths would fit into the Sun? 1.300

- 130,000 1.3 million
- 1.3 million
- 133 million

CUT ICE WITH A WIRE Watch as an ice cube divides under pressure before healing itself

KIT LIST

Two water bottles Two stools or chairs 45 centimetres of wire

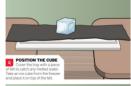
Trav Felt Ice cube







BUILD A BRIDGE about 15 centimetres away surface. Then balance the



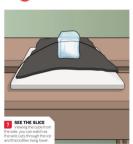




Вноштшо вкумва

HOLL IT LINDRS MRGBZINF







together again.

SUMMARY

The ice cube melts where the wire present down on it due to the applied pressure. As the wire is pulled downwarfs by the veight of the water and localised melting. When this pressure is removed, after the wire has passed below the melted parts of the ice cube. It refrecess in a process called regelation. This happens because only a small section has been metaled into desires water. When the pressure is goon, the temperature of the surrounding ice makes the water.

freeze back into its solid form. In nature, this melting process can be observed in glaciers. Just as the weight of the bottles increases the pressure on the ice cube, glacial ice experiences the highest pressure at the bottom of the block. This is due to the accumulative weight of the ice above. As the bottom of glaciers melt under pressure, the entire block of ice can become mobile and slide across the surface had been as a superior to the surface had been as the surface had been as the surface had been as the surface had the surface the surface had the surface the surface the surface the

Had a go? Let us know!

If you've tried out any of our experiments – or conducted some of your own – let us know! Share your photos or videos with us on social media.

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Twellier Fulluer Publishing our bioenployees can accept very subsity for any adverse
effective queries out of any time of a company out these proportion of any time of a
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NIGHT-TIME TALKING

Why do I sleen talk? P.S. I read my first HIW magazine at seven

years old Linve HIW Jason Thomas in Australia (11 years old)

Sleep talking is common in people of all ages, though it seems to affect fewer adults than children Doctors don't know too much about the causes of sleen talking but it can be more likely to occur when you're excited or worried. It can range from full conversational speech to mumbling and nonsensical words. Most of the time, episodes will only last for 30 seconds or less. While talking in your



About five per cent of adults sleep talk Scientists have discovered that sleen talking can take place in all stages of sleen.

Regular sleen talking may be genetic, but if it only occurs as a one-off, this could be caused by other factors. These include sickness, stress and sleep deprivation. Making sure you take time to relax before bed can reduce your chances of chatting.

CAFFEINE IMMUNITY

sleep can be linked to the dreams you are

having, this isn't always the case.

tea and coffee. It never stonged me sleening though Tused to sleep like a log with it. How did

Stephen Conn Caffeine affects each person differently. For some, it can be frustrating when a cup of coffee keeps them up all night, while others miss the boost of energy that others experience. If caffeine doesn't create stimulating effects, this may be due to your genetics. Around ten per cent of people carry a

gene that makes them hynosensitive to caffeine This means that they can drink lots of tea and coffee. like yourself, with little effect.

It takes around 45 minutes for your body to absorb the caffeine in a cup of coffee. Caffeine molecules bind to receptors on the ends of nerve cells in the brain to block the neurotransmitter adenosine. Adenosine usually encourages sleep, but caffeine prevents this. In your case, these receptors may be less effective at binding to the caffeine.





NEXT ISSUE ISSUE 159



ZIP LINE TESTING

Annabel Sword

Dear HIW I went on a zip line for the first time, which was so scary but amazing. I had never been on one before. but my friend has been on a few. It made me wonder were made. Are they relatively new?

Zip lines have been used through history se a method of

transport across mountainous areas for example in the Nullane Valley of China. This remote area once had many zip lines that people used to cross its rivers. Many have now been replaced with bridges as safer, more

permanent methods. The first zip line as a form of entertainment dates back to 1739 but modern zip lines rose in popularity in the 1970s. Biologists used them as tools to suspend themselves above jungle canopies and research the

environment around them, but the design was soon picked up by entrepreneurs and converted to rides for adrenaline seekers.



commercial zip lines



THE WORLD'S SMALLEST NATION

What is the smallest country in the world and Louise McCombie

Although its name has the word 'city' in it the smallest country in the world, based on landmass, is the Vatican City, Landlocked by Italy with a two-mile border surrounding it, this country is home to 800 people. The country with the smallest population is the Pitcairn Islands. The population has varied between 40 and 60 people over recent years, It's made up of four islands, located halfway between Peru and New Zealand.



TURTLE OR TORTOISE?

Dear HIW. Lahvays hear people get confused between furties and

tortoises, as they do look similar. Are they related? Although they look similar, they seem to have very different lives. Ionah Booth

Thank you for your question, Jonah. All tortoises are turtles, but not all turtles are tortoises. This is because the term 'turtle' can be used to refer to all species under the order Testudines, or Chelonia. These species are reptiles with bodies in a bony shell. The easiest way to differentiate between turtles and tortoises is to know that tortoises live only on land. However, to add to the confusion, some turtles - such as box turtles and wood turtles - also live on land.



WE ASKED YOU This month on

Instagram, we asked you: Which of the world's famous buildings and landmarks do you think is the most impressive?

> GISAMMY GLANEIFLD FI Canitan

TIDO MISII I think it's the Great Wall of China because of how lone it is!

Colosseum



St Basil's Cathedral in Russia

Sagrada Família as it has been under

construction for so long and is so intricately detailed

RESTHETICALLY AT Stonehenge is fascinating. with new information always being discovered





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FAST FACTS

3,735,219.15 MILES

All the Slinkies ever made would wran around the world 150 times



15 MILLION A pinhead of the Sun's core is hot enough to kill a person 100 miles away

DEGREES CELSIUS



1944

It's been less than 80 years since the last English woman was tried for witchcraft



HUMAN BODY GLOWS WITH A TINY

1928

In this year, the UK, US and Germany signed a treaty to end all war

All British passports

were written in
French until 1858



It would take less than an hour for you to fall through a hole to the other side of Earth





2022 TOYOTA DREAM CAR ART CONTEST

Entries are open for the 2022 Dream Car Art Contest

Great prizes to be won by designing a car for the future in Toyota's Dream Car Art Contest

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Ford Mustang GT **Build an Iconic Model**

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vehicle, marking the fiftieth anniversary of the Ford Mastona which was revealed as a 1965 model year which on April 12 1964. The sixth generation is also the first Ford Mustang to be marketed and said globally, and represented the first time that factory right hand drive Mustangs were produced in addition to



This vehicle has already became a true icon. You can create your own version at home with this Airfix QuickBuild kit. Recreate brilliant scale models of a wide variety of iconic aircraft, tanks and cars with QuickBuild kits. No paint or glue is required, the push together brick system results in a realistic, scale model that is compatible with other plastic brick brands

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